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ON THE EMPLOYMENT OF RADIO-ACTIVE MATTER IN SOLUTION

With a special view to the use of α -rays in treatment of the skin

by

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When Radium in its day was introduced into therapeutics it inspired very great expectations. Here was a source of rays similar to the X-rays but infinitely more powerful, and having the invaluable advantage that it could be applied direct to the spot to be treated. These great expectations have not been fully realized. One essential reason for this was the fact that by far the greater portion of the ray energy, moreover, the more powerful portion, viz. the α -rays, could not be utilized.

As is well known, radio-active matter emits 3 kinds of rays: the γ -rays which are identical with hard X-rays, consequently they are light-rays consisting of other vibrations, with very short wave lengths and with very rapid vibrations.

But these rays constitute only 1 % of the total ray energy emitted.

The β -rays are of quite a different nature, being rays consisting of an emission of ponderable material, namely of electrons. An electron is the smallest existing quantity of electricity. Its weight has been estimated at 8.8×10^{-28} g. As regards its size one has only hypothetic ideas, but in any case it is extremely small, and its specific gravity therefore extremely high. On the basis of certain theoretical estimations it has been asserted that 1 c. c. weighs 31,400 tons!

Modern atomic theories imagine that such small compact quantities of electricity are circulating with inconceivable velocity like miniature planets round the nucleus of the atom, which forms the centre of the small solar system of which an atom consists. But also within the nucleus itself electrons are circulating with enormous velocities.

In an atom of any radio-active matter some of the electrons circulating within the nucleus are released from time to time at irregular intervals and are hurled off with enormous velocity, which in the case of the fastest rays approaches that of light, while it is considerably less in others.

By reason of their diminutiveness and speed these particles possess a great power of penetration as regards the tissue, and therefore they play a very essential rôle in many forms of radium treatment. It ought to be mentioned, however, that a great portion is lost when the radium salt is enclosed in a metal capsule even a thin one which generally has to be done in order to protect the precious salt when it is being used. Even the ordinary thin silver tubes usually employed to hold the radium, which have a thickness of about 0,5 mm. absorb about $\frac{3}{4}$ of the β -rays. The very hardest rays though they are only a very small fraction (8—10 %), are able to penetrate 1 mm. of silver.

A still more tragic fate befalls the α -rays. They will never play any rôle in modern radium therapy, although they represent up to 99 % of the total energy, and in reality constitute a far stronger source of energy than either of the two rays previously mentioned.

The α -rays are by far the strongest source of energy known.

Like the β -rays they consist of an emission of small particles from the atoms of radio-active matter. These bodies too originate from the *atom nucleus* itself, which falls to pieces spontaneously without any known reason and these pieces are then hurled off with an enormous force. Their velocity is certainly only about $\frac{1}{10}$ of that of the β -particles ($\frac{1}{22}$ — $\frac{1}{13}$ of that of light), but their mass is very much greater. Their relative weights are 8000 to 1, or as a cannonball to a bullet. The effect they are able to produce is naturally in the same proportion, but their power of penetration is consequently far less than that of the β -particles. It varies somewhat in the different radio-active matters, though it is constant in each one separately. The matter that is most quickly transmuted emits the most powerful α -rays. Their power of penetration varies in atmospheric air from 3 to 8 cm. and in aluminium, for instance, from $\frac{1}{100}$ to $\frac{1}{40}$ mm. Even a piece of ordinary writing paper forms an almost impenetrable barrier to them. One can therefore easily understand that even the simplest case containing the radium salt must

act as an insuperable obstacle to the α -rays. For the treatment of tumours this is of course quite immaterial. In these cases one can not entertain any hope of deriving any real use from these rays.

But it is quite a different matter with the treatment of the skin. There the subject for one's treatment lies spread out flat, and is directly accessible. The thought presented itself easily to try to make use of the α -rays here. This has been attempted in Germany, where radio-active matter has been employed partly in solution and partly made into ointment. Both methods render a very intimate application on the skin possible.

For these experiments it has, however, not been possible to employ the *radium itself*. It is too *expensive*, and its period of disintegration is too long. As a standard for this time the so called *halving time* is always given, i. e. the period during which half of the matter is transmuted and a corresponding quantity of energy developed. The rapidity with which this happens is plainly proportional to the remaining quantity of untransmuted matter, so that the decomposition curve first falls precipitously and afterwards becomes more level.

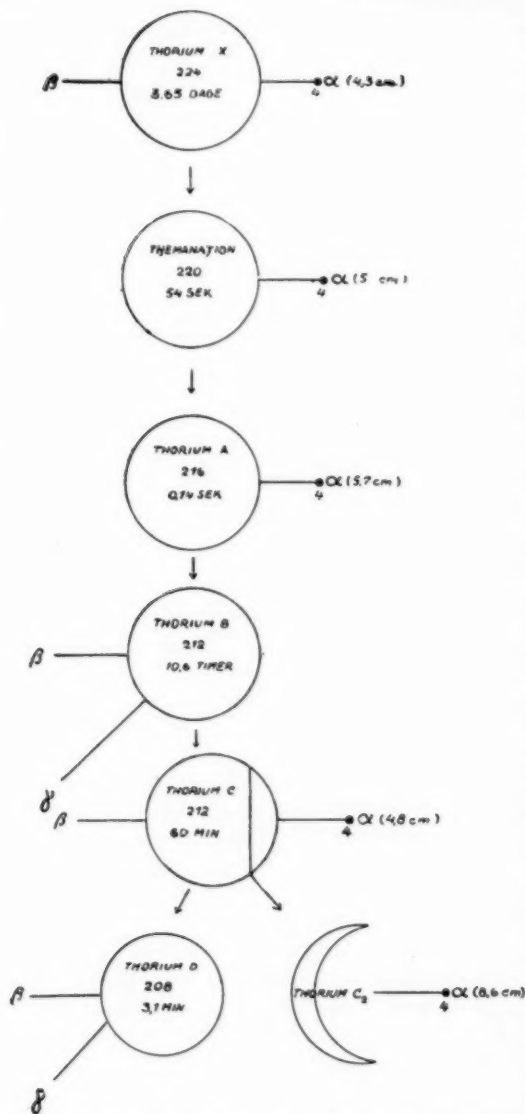
The halving time of radium is 1700 years. Therefore it is not at all suitable for use in a form which does not permit of regaining it, as it is such a minimum portion of the energy from which one can derive any benefit in the course of a few days.

It has therefore been necessary to employ another series of radio-active matter, where a more suitable was found, viz. the thorium series. This has in addition the advantage of being especially rich in α -rays. The first links in the thorium series cannot be utilized, as their halving period is too long. Neither thorium, mesothorium₁, mesothorium₂, nor radio-thorium are suitable.

But in the transmutation of radio-thorium a fifth body is formed, which has been called *thorium X*, and this is quite suitable. It is easily isolated and can be dissolved in water as well as in alcohol. Its place in the thorium series corresponds to radium in the radium series, but it is more active, as it has a much shorter halving time, and as it is succeeded by a whole series of quickly disappearing disintegration products, which also are extremely active. Hereby many and to some extent fairly deep-reaching α -rays are developed.

According to Rutherford, the processes which take place in the disintegration of an atom of *thorium X* is about as follows:

Thorium X, which has an atomic weight of 224 and a halving time of 3.65 days, is broken down, each atom emitting one α -particle (helium, atomic weight 4) and one β -particle: *thorium emanation* is thereby formed, with an atomic weight of 220 and a halving time



The figures in the circles indicate partly the size of the atoms (atom numbers) partly the halving time. The figures by the α -particles the power of penetration of these in the atmosphere.

of 54 seconds. Each atom of emanation thereupon again emits α -particle, whereby *thorium A* is formed, atomic weight 216 and halving time 0,14 sec. Again an α -particle is emitted and *thorium B* is formed, with atomic weight 222, and halving time 10,6 hours. Each atom of this emits one β - and one γ -ray, and *thorium C* is formed. This has an unchanged specific gravity of 212, as there is no helium atom emitted, and a halving time 1 hour. During the disintegration of thorium C slightly complicated conditions occur: some few atoms emit a β -particle and form thorium C₂, which again emits an α -particle. The great majority of atoms each emit a β -particle, and become *thorium D*, with an atomic weight of 208, and a halving time of 3,1 min. This substance again sends out β and γ -rays, and the disintegration is finished, a material being formed which is called thorium E. This has not yet been minutely investigated, and one does not know yet whether it is the ultimate product.

From this it will be seen that by the disintegration of thorium X an extraordinarily powerful ray energy is developed in a very short time, the α -rays being quite preponderant, namely 4 α -rays, 3 β -rays, and 2 γ -rays from each atom.

Thorium X is therefore especially well calculated to produce a powerful α -ray effect in a short time. In Germany the matter has been taken up in a business-like manner, and a wholesale production of thorium X has been started, which is sold in two forms, either made into an ointment or dissolved in propyl alcohol, in strengths varying from 500 to 6000 E. S. E. per c. c.

These preparations have been tested in a number of German clinics, and there has already appeared a series of publications about them. At present, as far as I have been able to ascertain, these reports¹ are, however, not very detailed and seem to be rather optimistic. These preparations have been tried in numerous skin affections, but as regards the majority of cases the result has been either so inferior that it does not invite to a repetition of the experiment, or else the same result can be obtained in some other and more easy way.

As regards two rather troublesome skin diseases, *psoriasis* and *lupus erythematodes*, remarkable results have, however, been reported. A series of *preliminary experiments* carried out at the Finsen Light Institute in 1920—21 on the initiative of Dr. WITTH gave such good results in some cases that they invited further tests. Experiments were made both with ointment and alcohol solutions of thorium X. The latter ones proved most effective and most economical in practice, and we have therefore used these exclusively in our later experiments.

The fact is, however, that much bitter disappointment has been caused by the employment of ray treatment, which has given rise to burns and other injurious effects. These may even occur after a very long time. Therefore it is of extreme importance to study from the very commencement of any new experiments what sort of rays may come into consideration, and especially when the technique of the method does not allow even of a far from satisfactory dosage. For, only on the certain presumption that only an effect of α -rays has to be considered, dare one expose the patient to such experiments. Because the α -rays are so short-reaching that they cannot penetrate so deep into the skin, that one need fear any deep and permanent injuries. Curiously enough, this important fact does not seem to have been discussed in the existing medical literature.

¹ Nägeli and Jessner: *Therapeutische Monatshefte*, Nov. 1913. Jadassohn: *Therapeutische Monatshefte*, Okt. 1915. Nagelschmidt: *Deutsche Med. Wochenschrift*, Nr. 7, 1916. Sluczewski: *Inauguraldissertation*, Berlin 1919.

nature. This seems all the more surprising as from the results obtained one would really expect that it must be a question of more deep-going rays than the α -rays. Most α -rays emitted by the thorium X and its products of decomposition are stopped by an aluminium leaf $\frac{1}{40}$ mm. thick, and therefore one cannot expect them to be able to penetrate more than $\frac{1}{10}$ of a millimetre into the skin. The absorbing power of certain stuff is in direct ratio to its specific gravity. The pathological processes that we are considering now, extend, however, a good deal deeper into the skin, generally 3 or 4 times as deep at least.

Therefore it would be an obvious conclusion that this effect is produced by a β -ray. Nevertheless, this does not seem to be the case. If a filtrating layer of thin gutta-percha, sufficient to absorb all the α -rays, is stuck on to the skin, before painting it with the thorium X solution, there will be neither the usual erythematic reaction nor any therapeutic effect upon the affection (upon a psoriasis patch for instance). In this respect we have made numerous experiments, all, however, with negative results.

In view of these experiences it will therefore seem justifiable to suppose that it is essentially an effect of α -rays that one is dealing with. But the great problem, the definite solution which I have not yet been able to find, is how this effect may nevertheless become sufficiently deep.

The first and most obvious explanation was that the effect of the α -particles might be of some other kind than their ionizing power. It is exclusively the latter that comes into consideration, when the range of the α -rays is spoken of, because this can be measured, whereas the path of the α -particle (the helium atom) cannot be followed after it has lost this ionizing power. For it must be supposed that the helium particle moves a certain distance after its ionizing power is lost. Further calculations show, however, that the amount of energy then remaining is only a minimum as compared with the amount of energy originally possessed by the α -particle. The loss of energy which takes place before the ionizing power is lost, constitutes by far the major portion of the total energy. Even though exact figures cannot be given, it is safe to say with a fair amount of certainty, that it can only be a question of fractions of a hundredth part at the very most.

Further it might be supposed that the *solution itself* might quite mechanically penetrate deeply when rubbed into the skin. This possibility cannot be quite excluded. Still, there are important reasons arguing against this possibility. Thorium X is isotopic, i. e. chemically identical with radium, and consequently belonging

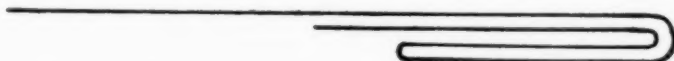
to the same group as barium. Barium is, as will be remembered, precipitated, in an insoluble form by all sulphates, and it is the same in the case of radium and consequently also in thorium X. It is therefore unlikely that it is able to penetrate to any depth worth mentioning. But also direct experiences oppose this explanation of the phenomenon.

In a series of the above-mentioned filtration experiments which I have performed on myself, thin tin-foil folded to a thickness of from one to several layers was used. Before it was applied the alcohol was entirely evaporated by heating, so that there remained only the precipitated thorium salts and a little chloride of calcium, which is found in the solution. A somewhat stronger concentration was employed in these experiments than in the ordinary treatment, and the effect obtained was also considerably greater than I have seen it at other times, with rather large blisters and subsequent excoriation, thus, a notably deep effect. This points against the mechanical painting being of any great importance, as in this case it was quite precluded owing to the vaporization. It is nearer the mark to presume that we are here dealing with a penetration of *emanation*. This gas still contains, as can be seen from tabula on p. 440, the major portion of the ray energy, and it is very natural to suppose that it is this that penetrates into the skin. As the emanation is an entirely «indifferent» gas, which is not precipitated by any other matter, it possesses the best possible qualifications for this. Various observations mentioned further on support this hypothesis in a rather positive manner.

This series of experiments, which I pursued, led to a number of instructive observations. As these give a good idea of the thorium effect and its progress, a little more detailed report on one series shall be given.

ARRANGEMENTS FOR EXPERIMENTS

A piece of thin tin-foil sheet (0,01 mm. thick) is folded up so that one part of the surface has a single layer, a second a double layer, and a third a quadruple layer (see illustration).



The smooth side of the sheet is coated as evenly as possible with a thick layer of thorium X solution. The tin-foil is put out

to dry and then cut in seven stripes $\frac{5}{4}$ cm. broad, and each being composed of the different layers.

The stripes are now placed on the skin (on the outer side of the calves), being stuck on with mastisol, with the painted surface outwards. Only a small piece is cut off and fixed with the painted surface direct on to the skin, so that the rays here act direct without a filter, while the rays from the upper surface of the stripe have to pass one, two, or four layers of tin-foil respectively. It is all carefully covered with large pieces of rubbercloth, which also are fixed on with mastisol.

The 7 stripes are removed one by one, at different times, the first after 24 hours, the second after 48, the third after 72 hours, and so on. They are numbered A, B, C, D, E, F, and G.

In this way an excellent combined variation of the experimental conditions is created, both as to time and to strength, i. e. according to the degree of filtration. A short report on the changes, observed as the stripes were gradually removed, will be given.

A. $^{15}/_{12}$. 24 hours. Slightly diffused erythema on the unfiltrated portion; on the filtrated portion there are only quite faint stripes along the edges, corresponding to cracks in the tin-foil.

B. $^{16}/_{12}$ (2 days). Redness a little stronger. In the filtrated portions the changes are notably weaker in those parts where the filter has been thickest.

C. $^{17}/_{12}$ (3 days). There is everywhere an even increase in strength of erythema.

D. $^{18}/_{12}$ (4 days). Considerable redness of unfiltrated portion, with incipient infiltration. Numerous, quite irregular patches of considerable redness are seen in the filtrated portion. They occur especially along the edges, or correspond to stripes where the tin-foil is cracked. The stripes are less sharply defined, with a tendency to diffusion in their immediate surroundings.

E. $^{19}/_{12}$ (5 days). Almost the same as D.

F. $^{20}/_{12}$ (6 days). Redness and noticeable infiltration in unfiltrated portion. In the filtrated portion there is now rather more redness over the whole surface, though concentrated in a striking manner round some irregular stripes and patches. Redness rather more pronounced upward than downward in those parts where the filtration has been strongest.

G. $^{21}/_{12}$ (7 days). Almost the same as F.

$^{21}/_{12}$. When all 7 patches are compared the following difference is found:

In the unfiltrated portions the difference in the strength of the reaction is relatively insignificant in the different patches though it is most apparent where the application has been longest. The filtrated portions give one the impression that the thickness of the filter is everywhere of relatively minor importance. The erythema stripes are almost as strong where the filter is thick as where it is thin, although a slight difference can be seen.

On the other hand, it is evident that the difference between filtrated and unfiltrated patches is lessened the longer the application lasts. With regard to

A and partly to B and C the reaction is chiefly seen only in places where there is probably emanation effect, viz. at the edge and at the cracks, while as regards stripe F and the rest it is far more diffusely distributed over the whole surface.

²⁰/₁₂. All the time the affection has been steadily developing, but as regards the patches treated for the shortest time it has no doubt been slightly on the decrease for the last few days. At times there has been a very intense burning and itching in the affected area. The itching has been most severe in the unfiltrated portions, especially in D, E, F & G. Also the infiltration has gradually become considerable. On the infiltrated portions of E, F & G there have been small vesicles which have burst and formed crusts. As regards D, E, F & G the reaction is of rather homogeneous strength in their respective unfiltrated portions. In the filtrated portions a noticeable increase is seen proportionate to the length of treatment. The reaction is obviously weaker in A, B and C, and their respective portions, filtrated as well as unfiltrated, show a well-marked even rise in the strength of the reaction, proportionate to the length of treatment.

²/₁. 22. Itching diminished, infiltration still strong, though perhaps slightly decreased. Affection a little more tender, especially in the unfiltrated portions of E, F & G. The unfiltrated portion of A is losing its redness a little and has assumed a more brownish appearance. The colour of the whole treated portion has become a deeper red, but seems a little less intense.

⁵/₁. 22. Itching has decreased somewhat, but the affection is more tender. Extensive erosion has set in on 4 of the unfiltrated patches, and on one of the filtrated ones (F). The redness is hardly so intense, a little more brownish. The infiltration certainly unchanged, though perhaps a little less.

¹⁰/₁. 22. Again a somewhat increased itching, though not intense. Erosions have become covered with crusts. Infiltration is now diminishing quickly, and has quite disappeared in the filtrated portions of A. The colour is now everywhere merging into brown.

¹⁴/₁. 22. The affection is now quickly settling down. Redness is subsiding leaving a brownish colour. Everywhere large, rather massive scales are forming. When these are ploughed off the skin appears smooth and pink, though still a little infiltrated. The desquamation begins a few days earlier on the patches that have been treated shortest, and the scales are here less massive, but the total impression does not vary much as regards the patches taken all together.

¹/₂. 22. The desquamation continues. The infiltration has disappeared long ago. At the places where the scales are sloughed off fairly thickly, the pigmentation is usually gone, leaving the skin pink. Distinct pigmentation is maintained along the edges.

¹/₃. 22. Still strong pigmentation with heavy desquamation. On the whole the pigmentation is strongest along the edges, being relatively weak at the places where a genuine desquamation has taken place.

¹/₄. 22. Still strong pigmentation, only slightly decreased. Some considerable desquamation of thin, flaky scales. At long intervals slight itching can still occur here and there in the patches. A slight, though undeniable atrophy is commencing in the patches where the reaction has been strongest, especially where there has been bullæ. The skin is here coloured whitish-

blue, only slightly pigmented, and apparently slightly atrophic. In folding, the folds are quite fine and thin. The hairs are, however untouched everywhere.

¹/₅. 22. Only a slight fading of the pigmentation since ¹/₄. 22.

¹/₁₁. 22. Pigmentation still visible in most of the patches.

The above observations of macroscopic changes necessarily prompted the desire to have them supplemented and more carefully analysed by histological investigations.

The changes that had taken place resembled in many respects those well known in X-ray dermatitis, yet they differed decidedly from these by their combination of rapid appearance and quick, almost traceless disappearance, in spite of the apparent violence of their onset. What was the reason for this difference? Here histologic investigations might afford valuable information.

Another problem, which has been previously touched upon, was the difficulty in understanding how, as experience shows, one can obtain clinical results in relatively deep layers of skin by means of rays which, like the α -rays, are only apt to penetrate quite superficially into the tissue.

As no such investigations have been reported before in literature, it became necessary to institute them. I therefore decided to make a series of experiments on myself with biopsy of pieces of skin, which had been previously treated with thorium X solution for a shorter or longer time.

As subject for my experiment I chose the skin of my legs. This had the advantage, amongst other things, of being rather thick, so that it could be safely presumed that changes which could be obtained in its different layers might easily be obtained in the same layers of the skin in most other parts of the body, and especially so in the thin, fine skin of the face.

As regards the second factor, the strength of the treatment, this, as previously mentioned, was made relatively strong with a view to obtaining distinctly demonstrable histological changes as far-reaching as possible. Indeed the reactions obtained were almost all perceptibly stronger than those which were obtained by the use of therapeutic doses. Only skin which had been treated direct with thorium, without an intervening filter, was examined, tin-foil painted with thorium solution being placed on the skin with the painted side inwards. Altogether 9 excisions were made, from 1 day to 5 weeks after the commencement of the treatment, and one finally after four months.

By examining microscopically these pieces of skin an increasing effect on the tissue could be observed for a certain time: about two

weeks. Up till the time when the effect reached its climax, its increase was steady and of course became most conspicuous at the moment when the basal layer of the epidermis was quite dissolved. However, this was not always the case.

An increase in the effect on the corium was also observed, and this was especially the case as regards the most conspicuous effect observed here, i. e. the inflammatory infiltrations near the vessels.

A further analysis of the effect gave about the following result:

(Edema of the epidermic cells sets in; the capacity for staining is lost; the nuclei shrink; the chromatin is either not stained or forms a highly stained clump; finally, there is complete necrosis, strongest in the oldest (and least vital) cells, i. e. the uppermost ones.

The cellular œdema and the cellular necrosis also invade the corium, with its bunches of connective tissue. The connective tissue becomes less changed than the cells of the epidermis, but here, too, degeneration occurs, although it is strongly pronounced only in the superficial layers of the connective tissue, without being sharply defined towards the healthy tissue. The next most conspicuous feature is the change which takes place in the appearance of the fibroblasts, and which corresponds to what is seen in other conditions of inflammation and irritation: the cells of the connective tissue become more numerous and at the same time more heterogeneous. Gradually, as this change is accomplished, the new type appearing will predominate in the picture, but only for a while. Finally the cells resume their old appearance.

Often, perhaps, it is the appearance of the cells more than their increase in number that is conspicuous. The original, narrow, almost linear-shaped nucleus of the fibroblasts becomes fuller, and assumes either a rather regular oval shape or, in other cases, a more irregular contour.

These conditions are most easily observed in the papillary body, but a change also occurs in the more deeply situated connective tissue cells. While the great changes in the epidermis are easily restored, it seems that a slight flattening of the bunches of connective tissue in the upper portion of the corium may persist after a strong influence. This condition can also be found in the aspect of the elastic tissue, which otherwise does not present any changes.

The description of a piece of skin excised after 3 days treatment may serve as an illustration of the least pronounced changes.

After the horny layer, which measures 100 μ follows a stratum spinosum, where some of the cells have a clearer appearance (with unstained protoplasm and slightly shrunken and homogeneously stained nuclei). Cells of this kind

are found throughout the entire epithelium, though most frequently in the superficial layers. From its lowest boundary to the surface the epidermis measures from 300 μ to 525 μ .

In the papillary body there is a slight increase in the number of the fibroblasts, in the same way as the nuclei of the capillaries are increased. On the other hand, the vessels in the reticular layer are accompanied by a quite indisputable infiltration, lymphocytes and cells resembling connective tissue cells. (Also in skin specimens excised after 1 or 2 days resp. beginning changes in a similar direction were seen. Indubitable changes were observed already after 24 hours, especially in the epithelium but also in the cutis.)

5 days later. After the horny layer of the epidermis, measuring 75 μ , follows a parakeratotic cell layer measuring 150 μ , then an oedematous stratum spinosum and stratum basale. Extensive degeneration of the cells is seen in the stratum spinosum, though not equally pronounced everywhere. From the parakeratotic layer to the papillae and the bottom of the interpapillary depressions the epidermis measures from 225 μ to 450 μ resp.

There is a slight increase of cells in the vessels of the papillary body, where there are also more connective tissue cells than normal. Round the vessels in stratum reticulare and at a single follicle also infiltrations are seen, which are as much as 150 μ in breadth.

7 days later the horny layer is seen to be thickened; then comes a parakeratotic layer with oedematous interstices, which merges into a layer with scanty, shrunken nuclei and a few lymphocytes. Then comes a layer with distinct oedema, scanty shrunken nuclei, and solitary polynuclear cells. Finally, farthest down in the epidermis are a couple of cell layers with undiminished, but in part greatly oedematous cells with less stainable nuclei, and clumps of chromatin.

At a deep place the horny layer measures from 30 to 60 μ , and the two following, the parakeratotic and the more spinosum-like layer, from 75 to 100 μ .

Corium almost as in last specimen.

11 days later cells and nuclei in the deep layers of the epidermis can only just be distinguished as vague outlines, the nuclear bodies or a similar large chromatin body keeping the stain longest.

The total height of the epidermis is as much as 475 μ . In the papillary body there is, as in the previous specimens an increase of the connective tissue cells, and here as well as in the stratum reticulare an infiltration is seen round the vessels.

14 days later. The greatest portion of the epidermis, which measures 225 μ , made up of parakeratotic or only keratotic layers with nuclear remains or round cells. If the deepest layers do not present much the same picture, with scant, horizontally placed, longish, degenerated nuclei, one finds badly preserved cell boundaries, badly stainable protoplasm, degenerated nuclei and an obliterated stratum cylindricum.

The most superficial capillaries in the papillary body are distended and filled with an amorphous mass. There is oedema in the papillary body, and in some places lymphocytes, degenerated round cells and a number of connective tissue cells. A similar increase of cells is found round vessels and follicles and some sweat gland tubules; there may, however also be some entirely lymphocytic infiltrations here. In a small portion of the uppermost.

corium a striking poverty in cells is found together with some indistinctness (obliteration of the connective tissue fibrils). The picture of the elastic tissue presents no changes.

5 weeks later. Parakeratotic horny layers are seen uppermost, and then a well developed stratum granulosum and stratum spinosum. The latter shows a comparatively well-stained protoplasm and some acanthosis. The deepest cell layer is seen very distinct as a stratum cylindricum, and there are numerous projections from the epidermis.

The layer above the stratum granulosum measures $100\ \mu$, at its smallest height, but generally $300-400\ \mu$. The deepest portion of the epidermis — stratum spinosum p. p. — measures about $140-210\ \mu$ in height.

In the papillary body various young connective tissue cells are seen. At the first glance there seem to be no remains of any infiltration round the vessels in the corium. On further examination, however, a small number of degenerated round cells are found lying around some vessels.

5 months later. The horny layer is about $275\ \mu$, the rest of the epidermis from 150 to $300\ \mu$. The projections from the epithelium are only slightly pronounced, but are nevertheless present.

In the basal layer of the epidermis there is scanty pigmentation, homogeneously distributed over the whole specimen.

There is doubtless a slight subepithelial atrophy of the collagenous tissue, and the elastic tissue seems slightly compressed.

In some few places a little below the epithelium and parallel with this a very faint stripe like mitotic zone is seen, consisting mostly of connective tissue cells.

Thus, it was seen that the epithelial changes were very small during the first days, but then increased rapidly; were rather considerable after 11 days, and greater still after 14 days. Then they decreased again, and at the end of 5 weeks they had almost disappeared or were fast disappearing. The changes in the papillary layer were of a similar kind. From the very beginning the infiltrations round the vessels and follicles were at once easily recognized; though very faint at first they increased gradually, but disappeared relatively quickly, and were almost gone already after 14 days.

As regards the other changes in the corium it is best to refer to the descriptions given above.

As we have seen, the changes described here coincide in the main with the changes produced by Roentgen and Radium and which are rather well known (see WETTERER: Handbuch der Roentgen und Radium therapy).

The reaction of the vessels, which is a prominent feature in the picture, may be easily explained as a result of an influence from the chemical substances which are liberated or formed by the mild, gradual cell destruction produced by the irradiation. One need scarcely presume the presence of a special elective influence upon the

cells of the vessel walls, except perhaps in those cases where regular ulceration occurs after Roentgen irradiation.

As regards the latent period which is so often observed in Roentgen and Radium irradiations, it has been thought to represent the time that elapses from the moment the cells lose their mitotic ability until the ultimate death of the cell occurs. Such a latent period does not occur with the same distinctness in thorium treatment. However, it is probably a parallel phenomenon: when for example after two weeks one can see that only a single cell layer in the epidermis has a fairly healthy appearance, namely the deepest one, while the layers lying immediately above it look as though they had already passed through their entire process of maturation, without any normal substitution having come gradually from the deep layers.

This view, that it is the destruction of the power of the cells to divide in the normal manner by mitosis, which is the essential point in the ray effects mentioned here, is not contradicted by the fact that, as WETTERER amongst others has pointed out, individual amitoses can be seen now and again in a tissue treated in this manner. This can also be seen in several places in the preparations described here, indeed, in a few places one may also find some abnormal, «morbid» signs of mitosis.

In these circumstances it is not very difficult to imagine that a therapeutic effect can also be obtained. The principal symptom in lupus erythematodes, for example, is a peculiar stationary process of inflammation, but no doubt it will be set in motion by such a strong influence as the one in question. It is no doubt also of great importance that the strong regeneration which the thorium irradiation sets up in the tissue must necessarily produce a considerable hyperemia in this.

This irradiation produces doubtless also by itself round-celled infiltrations round the vessels, but these infiltrations are quite different from those found in Lupus erythematodes; they disappear spontaneously, while, on the contrary, the rays act with deadly effect just on the pathological cell forms existing in the tissue at the commencement of the treatment.

If from what has already been stated, one should try to find an answer to any of the questions discussed above, it would be about as follows:

The relation to the Roentgen effect has already been mentioned several times. The principal difference lies apparently in the fact that we are here dealing with rays which, on the one hand, seem to be materially more powerful, in that they more quickly and more

strongly show there deleterious effect on the tissues, especially on the pathological cell forms, but which at the same time have such a superficial effect that they do not produce a really deep destruction of the tissue, but allow of a possible replacement taking place from the deeper layers in the skin.

The question of the deep effect of the rays does not permit of an exhaustive answer, as it is impossible to distinguish sharply between the primary, direct, destructive effect on the cells and the undoubtedly rather heterogeneous secondary influences following this.

When, however, we find necrotic epidermic cells at a depth of from 500 to 600 μ , for instance in the first specimen of skin which has only been treated for 72 hours, it seems to me natural to conclude that we are here faced with a direct effect, and when this appears so much deeper than might have been expected (100—200 μ), it must undoubtedly be due to a direct penetration of radio-active matter (*emanation*) into the skin itself.

If after these more general considerations we now turn to the special therapeutic subject, our first task will be to ascertain what one may hope to gain by this treatment, and under what conditions.

The short durability of the preparation demands as far as possible its immediate employment, and in order to make use of it in a reasonably economical way it will be rational to leave it on the skin for at least 5 or 6 days. In the literature to hand many statements are to be found by authors who have left it on for only a couple of days. This is decidedly un-economical, and my experiences show to a certainty that a long application produces a considerably stronger effect. Moreover, it ought to be far more emphasized than it generally has been done, how immensely important it is that *the cover employed fits tightly*, as otherwise the emanation will escape. Mostly a simple covering of collodium is recommended as a normal method. In my experience this is a very imperfect technique. Collodium bursts rather quickly in many places and very quickly begins to peel off. In these circumstances the effect is always considerably less than when a tight-fitting dressing is employed.

The importance of the emanation deserves to be brought considerably more to the fore than has hitherto been the case. Because if the emanation is lost, then, as already mentioned, theoretically $\frac{3}{4}$, and in practice more than half, of the rays are lost. Many will perhaps take a sceptical view of the possibility of such a rapid

escape of the emanation. Particularly the very short halving-time of 54 seconds will be pointed to, but to this it must at once be replied that even if the durability of this gas is certainly rather short, on the other hand it is extremely «alive». All atoms that split receive a very strong recoil when the «projectile goes off». According to a numerical calculation this recoil should be able to move the atom at least 1 mm., or $\frac{1}{50}$ -th part of the way the fifty times smaller helium atom moves. Excellent conditions are hereby created for a quick diffusion to set in. *On the whole, gases diffuse very rapidly.*

In any case it is a fact that we have several times observed very severe erythema round the part treated with thorium direct. This was particularly clear in the case of a female patient who had been painted on some lupus erythematodes patches in the fold under her right breast. The painting was covered with collodium. But already after a few days a severe erythema set in apposed on the surfaces of the breast and thorax. The erythema stopped with a very sharp boundary where the two skin surfaces separated, and it was accompanied by the well-known thorium itch. Any other explanation is hardly possible but that here was the case of an emanation effect, which dissappeared as soon as the emanation was able to diffuse freely into the air.

Similar observations have been made in several more patients though in a less pronounced form. Also in my various experiments on myself, erythematous stripes and tongues were seen extending from the thorium-painted tin-foil sheet placed on the skin and corresponding to folds in the covering layer of the rubber cloth.

A patient who was treated over the cheek bone, close to the right eye, acquired a slightly erythematous itching conjunctivitis, which in my opinion must also be interpreted as an emanation effect.

Therefore one must pay great attention to the emanation, and employ quite tight-fitting dressings. For this purpose a quite thin gutta-percha sheet is most suitable, which is stuck on with mastisol, and outside this a gauze dressing is applied. In certain places, however, one must keep to collodium only, on the ears for example, but then the effect is always weaker. American court-plaster also gives an excellent effect. The skin under the gutta-percha dressing becomes slightly macerated, but the penetration of the emanation into the skin is only facilitated thereby.

From the foregoing considerations it is evident both that one may and dare employ a more energetic mode of dosing with thorium X in solution than is usual in other ray-therapy. Thus, one must always endeavour to produce an erythema and preferably a rather

vigorous one, whereas one ought to avoid bullate reactions. After these follows, as I have myself observed in several cases, a slight atrophy of the skin which, however, even though as a rule it is only just visible, should be avoided. Loss of hair is, for instance never seen, and delayed effects need not be feared.

When the reaction has subsided a more or less pronounced pigmentation appears, which is generally strongest in a zone bordering towards the healthy skin. The pigmentation is very obstinate, and remains for many months. In visible parts of the skin this may of course prove rather embarrassing.

It is most peculiar that these pigmentations are relatively seldom found in the face. Thus, only a very few of the patients treated for erythematodes have got it, especially not on nose and cheeks. The pigmentation occurs rather on the forehead. This circumstance greatly facilitates the treatment of erythematodes, but it is impossible for me to give any explanation of this. Still, it should be emphasized that the pigmentation in the face may certainly occur, and that consequently one *must* reckon with this possibility so as not to run the risk of meeting with most disagreeable surprises later on.

As a rule, we have been able to obtain an effect, such as has been described above as being the most suitable, by giving 3 paintings with a solution containing thorium X in a concentration of 3000 E. S. E. per c. c. It must be mentioned, however, that as a rule 48 hours have elapsed between the production and the employment of the preparation, during which time its radio-active energy must be reckoned to have diminished by about 25 %.

The treated surface is covered with collodium and then with pieces of thin gutta-percha, and left untouched for 5 days and nights, as mentioned above.

If we now turn to the *clinical experiments*, these may be divided into two groups, according to the two diseases treated, *lupus erythematodes* and *psoriasis*.

The principal investigation has been directed the to treatment of lupus erythematodes. This disease is a real «cross» to the doctor. Capricious, refractory to every treatment, and chronic in the extreme, it causes great difficulties. Of the *three principal treatments* hitherto at disposal, the *Roentgen treatment* is only slightly active but dangerous, because of the necessary frequent repetition of the treatment. *Freezing* with carbonic acid snow is comparatively safe, but rather painful for the patient, and produces unfortunately only little effect in many of the severest forms. The best method is undoubtedly the concentrated *Finsen light*, but this is also painful, and especially

lengthy and expensive, at any rate in cases where the affection is extensive.

In these cases the *thorium treatment* shows its superiority by its complete painlessness, except for some itching that may occur 1—3 weeks subsequent to treatment; and it might also be said at once that the effect on many patients is surprisingly good. When the erythematous stage is passed, the closely adhering, troublesome scale disappears in most cases together with the redness, the skin becomes smooth and assumes a more natural colour. In short, the first impression is excellent, and there can be absolutely no doubt but that the substance has quite an excellent *symptomatic* effect. In most cases a desquamation and decrustation and a strong decrease of the infiltration is obtained, and after some time also a fading of the redness. This latter is, however, the symptom that is affected most slowly, which is only natural. In this manner one may, thus, in a number of cases make the entire diseased patch disappear gradually, leaving only a slight whitish, scar-like change in the skin.

But in most cases a slight infiltration will remain at the edges, and in these places particularly a relapse will be seen to occur after 1 or 2 months, originating especially from the distended follicle mouths thickened by keratosis. The relapse is, however, as a rule considerably less than the original affection, and by renewed treatment one often succeeds in making it disappear again and for good, so that complete recovery is gradually secured. The result is, however, often only an *improvement*, and even this is frequently only temporary. Little by little an affection develops, quite as large as the original one, and naturally one cannot prevent fresh eruptions on healthy skin.

We have never observed a direct aggravation during the treatment.

The Thorium treatment has one very essential advantage, viz. that it is extremely easy for the doctor to administer and comfortable and clean for the patient.

To express the results in figures the material must be divided up into light, medium and severe and obstinate cases, and the results obtained must be divided up with regard to whether there has been recovery, improvement, or no result at all. Further, one must also take into consideration the strength of the treatment, whether it has been sufficient or insufficient.

In other respects the statements must be quite brief and summary, as a more detailed report will take an unreasonable space, without giving any great result. The fact is evidently, that

it is quite impossible to fix any rules or symptoms by which the cases that are susceptible to treatment differ from the others. It seems to be rather variable. For it is of course obvious that considerably better results are obtained in the light cases than in old, inveterate, severe ones, but this rule holds by no means always. A few relatively light cases have proved entirely refractory, while many very severe cases have been much improved and some, indeed, have even been cured. One may perhaps say, however, that the depth of the lesion seems to be of greater importance than its extension. Moreover, I have had the impression that lesions on the nose are particularly obstinate. This must presumably be due to the large, deeply situated sebaceous glands, the seat of the disease being in consequence relatively deep.

When considering the material it must be remembered that the cases have been many years old, severe, deep, and on an average have been treated several times both with Finsen light and carbonic acid snow. In the course of years the Finsen Institute has become the place, the «ultimum refugium», where patients who have in vain looked for help elsewhere have taken refuge. In the course of time these old cases have accumulated to form quite a large stock, and on all these patients this new treatment has been tried, and has in many cases really afforded an unmistakable improvement, at all events temporarily. As regards the permanency of the improvement it is impossible to say anything definitely after the lapse of only one year. Here one must be prepared for disappointments. At any rate there has been a good symptomatic effect in many cases, and even this is a great boon to these people, who often suffer from their disfiguring affliction far more than is imagined, and as the treatment is easily carried out and no doubt is quite harmless, it will certainly give a good result.

The Finsen treatment, which is perhaps the only one superior to it, is considerably more troublesome, painful, and expensive.

The treatment has been tried on 71 patients in all, but 21 of these must be excluded on account of too short a period of observation, or because of the treatment having been so short that no verdict can be given. It has been found that sex does not play any rôle whatever as to the progress of the disease and the effect of the treatment, for which reason I have given up classifying the cases according to sex, as it only causes confusion. It must be noted, however, that female patients are everywhere in great majority.

Of the 50 cases set forth in the following tabula only 17 or $\frac{1}{3}$ were males.

		Apparently cured	remarkably improved	Improved	Unchanged
Light	cases	3	3	4	2
Medium	"	5	3	4	1
Severe	"	2	12	7	3

As regards the improvement obtained, which has been observed in many cases, it must be mentioned that this shows itself especially with regard to the scaly crusts. They are easily made to slough off. The infiltration is more resistant, but in some cases this also disappears, and it is then as a rule the central areas that first show improvement, while the infiltration in the peripheral zone may remain very obstinate. The redness lasts longest, and only when there is no more to be seen but a white, smooth scar can the recovery be regarded as definite.

PSORIASIS

In psoriasis the conditions are considerably more favourable than in lupus erythematoses. One may say that the great majority of psoriasis patches can be made to disappear by one single treatment, or by quite few. Old, greatly infiltrated patches are an exception, however. This disease is also, however, fairly susceptible to many other forms of treatment. It is only its unpleasant tendency to relapse that has proved unconquerable, and neither is Thorium X able to conquer it. The problem is therefore to ascertain the special conditions in Thorium X treatment, and to determine on the basis of these the necessary indications.

Before doing this I shall give a short account of the patients we have treated. 44 patients in all have been treated. In 21 of these the symptoms were successfully overcome within a fairly short time, while in 23 they were *almost* removed. Only one case remained almost uninfluenced. Unfortunately, in rather a large number of cases slight relapses quickly occurred, which in most cases, however, could be favourably influenced.

These investigations show that, with regard to the permanency of the results obtained, which may be said to be the most important point in the treatment of psoriasis, there is no certain difference between this and the older forms of treatment, in any case not *in favour* of thorium X. Its advantage is that it is a *cleanly* treatment, especially as compared with the ointment treatment, and even though it be relatively expensive, this drawback is rather outweighed by the fact that one, or perhaps a few treatments at the most may

be sufficient. Ointment has nowadays become prohibitively expensive, and also often contains substances that are ruinous to clothes. The thorium treatment is also considerably *easier*, a point which also is true when compared with the Roentgen treatment. Thorium X has the further advantage over the latter treatment that, so far as we have hitherto been able to ascertain, it involves no danger of skin atrophy, at any rate not in any serious form.

But it has one tiresome drawback, the oft-mentioned pigmentation. After having been treated for severe psoriasis by thorium X, the patient will in many cases look something like a leopard, and these light-brown patches may persist for many months. This disagreeableness is felt most keenly on the arms, and in the case of women also on the shoulders, neck, and chest. In all our cases the disposition to pigmentation of the face has been remarkably small, so that we have even considered psoriasis *in the face* as an especially good indication for thorium treatment, particularly in patients who on account of their work cannot very well use ointment. In such case one must naturally confine oneself to use only collodium as a covering. For the same reason this treatment is admirably suited to the *hands*. Also on the *scalp* it has often an excellent effect, which is all the more surprising as one cannot here apply an effective covering.

The indications just mentioned are in my opinion some of the most important for thorium treatment. To this must be added the not unfrequent cases where the patient's external circumstances make it difficult to carry out an ointment treatment, or where it is greatly desired to avoid such.

Finally we have the last and perhaps the most important group, the little group of cases which obstinately resist every other form of treatment. Here a trial with thorium X should not be omitted, especially in those cases where it is always the same few patches that persist. We have seen a couple of such cases recover admirably. One was a business man aged 50, who for 30 years had suffered from a very persistent psoriasis, which had been vainly treated with all sorts of ointments by many different doctors. In his case thorium X brought about a quite remarkable improvement. Even some very severe keratotic patches on the soles of his feet were successfully overcome by one treatment alone.

If we desire to sum up our experiences of thorium X both in the case of erythematodes and psoriasis, the result will be that in neither case has it given such brilliant results that it can be offered as a standard treatment, but that, on the other hand, it be of aid, even of excellent aid, in a number of cases where all other remedies

have failed, and should therefore by all means be tried. To this must be added the many cases where the thorium treatment is to be preferred because of its cleanliness and easy application. Finally it should be emphasized that, as far as is known, it entails no serious points of danger, at the most an inconvenient tendency in some cases to produce pigmentation.

It should further be emphasized that this treatment is far from having been thoroughly tested as yet. Therefore there is every possible reason to carry on new investigations and experiments. This might perhaps pave the way for such improvements in the technique that the results would become far better still.

I offer my best thanks to my chief, Dr. REYN, for his permission to perform and report on these investigations, and for the interest with which he has followed them, and further to Dr. K. A. HEIBERG for his valuable assistance in interpreting the histological features.

SUMMARY.

1. The active element in the treatment by thorium X is the α -rays.
2. The relatively deep effect on the skin must naturally be regarded as a mechanical penetration into the skin by thorium X or its transmutation products, *especially by emanation*.
3. In order to utilize the substance fully, it has been found to be of great importance to try to retain its transmutation products, especially the emanation. Covering with thin gutta-percha sheets, court-plaster, or such like is therefore to be recommended.
4. The substance is best employed dissolved in alcohol, which is painted on the affected part of the skin, and is then covered over and left on for 5 days.
5. The reaction shows itself in the course of 24 hours as a slight erythema, which then slowly increases in strength, with strong reactions during the first 2—3 weeks. In the case of a particularly strong influence the reaction may increase so as to produce bullae. In the latter case the reaction may leave a slight atrophy of the skin, without, however, the glandular organs of the skin being injured. Of other unpleasant after-effects only pigmentation of the treated area of the skin has been observed. This may remain for several months. The skin of the face seems less susceptible to pigmentation than the rest of the skin.
6. The anatomo-pathological changes very much resemble the changes produced by the Roentgen rays. They consist of an advancing degeneration of the entire epithelium. The climax is reached after a fortnight, when the new formation commences. Cell changes occur also in the corium but are far less pronounced, at the same time the cells increase in number, and a younger cell-type appears in the meantime. These cell changes are accompanied by a passing inflammatory infiltration round the vessels.
7. The clinical results obtained by the treatment of lupus erythematoses

and psoriasis consisted as a rule of a good symptomatic effect, whereas a really permanent cure was obtained only in a small number of cases.

8. Thorium treatment possesses several essential advantages over other methods of treatment: it is easy, clean, and agreeable to use, and does not, like the Roentgen and other radium treatment, entail any risks of deep burns or of any delayed harmful after-effects.

ZUSAMMENFASSUNG

1. Das aktive Element in der Behandlung mit Thorium X sind die α -Strahlen.

2. Die relativ tiefe Wirkung auf die Haut muss man natürlich als eine mechanische Penetration des Thoriums X oder seiner Zerfallsprodukte, *speziell der Emanation*, in die Haut auffassen.

3. Um die Substanz zur Gänze auszunützen, hat es sich als äusserst wichtig erwiesen, ihre Umwandlungsprodukte, besonders die Emanation möglichst zurückzuhalten. Bedeckung mit dünnen Guttaperchablättern, Englischpflaster o. dgl. ist deshalb zu empfehlen.

4. Die Substanz wird am besten in alkoholischer Lösung verwendet, welche auf die affizierte Hautpartie aufgestrichen und bedeckt wird, worauf man sie 5 Tage liegen lässt.

5. Die Reaktion zeigt sich im Laufe von 24 Stunden als ein leichtes Erythem, welches dann langsam stärker wird, mit starker Reaktion während der ersten 2—3 Wochen. In Fällen von besonders starker Einwirkung kann die Reaktion sich bis zur Blasenbildung steigern. Im letzteren Fall kann eine leichte Hautatrophie zurückbleiben, ohne dass jedoch die drüsigen Organe der Haut dabei Schaden litten. Von anderen unangenehmen Nachwirkungen ist nur Pigmentation der behandelten Hautarea zur Beobachtung gekommen. Eine solche kann mehrere Monate anhalten. Die Gesichtshaut scheint dabei weniger zur Pigmentation zu neigen als andere Hautpartien.

6. Die pathologisch-anatomischen Veränderungen ähneln sehr den durch Röntgenstrahlen verursachten. Sie bestehen aus einer fortschreitenden Degeneration des ganzen Epithels. Der Höhepunkt ist nach etwa 14 Tagen erreicht, worauf die Neubildung beginnt. Auch im Corium kommen Zellveränderungen vor, sie sind hier aber weit weniger ausgesprochen. Gleichzeitig nehmen die Zellen an Zahl zu und es tritt allmählich ein jüngerer Zellentypus auf. Diese Zellveränderungen sind von einer vorübergehenden entzündlichen Infiltration um die Gefässe herum begleitet.

7. Die bei der Behandlung von Lupus erythematodes und Psoriasis erreichten klinischen Resultate bestanden in der Regel in einer guten symptomatischen Wirkung, während eine wirkliche dauernde Heilung nur in einer kleinen Zahl von Fällen erreicht wurde.

8. Die Thoriumbehandlung besitzt mehrere wesentliche Vorteile vor anderen therapeutischen Methoden: Sie ist leicht, rein, angenehm im Gebrauch und nicht wie die Röntgenbehandlung oder die Radiumbehandlung anderer Art mit irgendwelchen Risiken tieferer Verbrennung oder verspäteter böser Nachwirkungen verbunden.

RÉSUMÉ

1. Ce sont les rayons α qui sont actifs dans le traitement avec le thorium X.

2. Il faut supposer que l'effet relativement profond sur la peau est dû à une pénétration mécanique dans la peau du thorium X ou des produits de sa désagrégation, spécialement de l'émanation.

3. Pour utiliser complètement la substance il est d'une grande importance de retenir ses produits de désagrégation, surtout l'émanation. Il est recommandable de recouvrir l'endroit traité par des feuilles minces de gutta-perca, de taffetas anglais ou chose analogue.

4. Il est le plus avantageux de dissoudre la substance dans de l'alcool, de X l'étendre sur la peau affectée, de la recouvrir et de l'y laisser pour 5 jours.

5. La réaction apparaît dans les premières 24 heures comme un léger érythème, augmentant lentement dans la suite avec fortes réactions durant les 2-3 premières semaines. Dans le cas où l'influence est particulièrement forte la réaction peut augmenter jusqu'à former des bulles. Dans ce dernier cas il peut résulter une légère atrophie de la peau, les organes glandulaires de la peau restant toutefois intacts. En fait d'autres suites déplaisantes on n'a observé qu'une pigmentation de la peau traitée qui peut subsister plusieurs mois. La peau de la figure semble être moins susceptible à la pigmentation que le reste de la peau.

6. Les changements anatomo-pathologiques ressemblent beaucoup à ceux provoqués par les rayons X. Ils consistent en une dégénération progressive de l'épithélium complet. Le point culminant est atteint après une quinzaine quand la nouvelle peau commence à se former. Des changements ont aussi lieu dans le derme mais ils sont bien moins prononcés; en même temps le nombre des cellules augmente et un nouveau type de cellules apparaît. Ces changements de cellules sont accompagnés d'une infiltration inflammatoire autour des vaisseaux.

7. Les résultats cliniques obtenus par un traitement du lupus érythémateux et du psoriasis montraient en règle un bon effet symptomatique; pourtant une guérison permanente n'a été obtenue que dans un nombre restreint de cas.

8. Le traitement avec le thorium X a quelques avantages essentiels comparé à d'autres méthodes: l'emploi en est facile, propre, agréable, et, contrairement aux rayons X et autre traitement radiologique, il n'y a aucun risque de brûlures profondes et de suites désastreuses attardées.



PLEURITIS MEDIASTINALIS¹

by

Dr. J. B. Polak

(Tabula XIX)

The case I want to report on here, seemed to me to be of some importance for two reasons. In the first place there are remarkably few publications about this form of pleurisy to be found in the literature, in the second place the Roentgenexamination is of the greatest importance for the diagnosis of this affection, and therefore it does not seem superfluous to discuss the result of this examination.

The space where we find the exudates under discussion is bounded externally by the median surface of the lung, internally by the mediastinal organs. Looking closer at this space, it is obvious, that we may think of it as divided into an anterior and a posterior portion, separated from each other by the root of the lung. The anterior portion is bounded in front by the anterior thoracic wall, internally by the heart, posteriorly by the root of the lung, externally by the median surface of the lung. The latter also forms the external boundary of the posterior space, while this portion is bounded in front by the roots of the lungs, internally by the organs situated between the heart and spinal column and by the spinal column itself, behind by the posterior thoracic wall. The physical and the Roentgen symptoms will differ according to the localisation of the exudate in one of these four divisions. If the encapsulated exudate is situated in front of the root of the lung, constituting thus a pleuritis mediastinalis anterior, the dullness over the heart will, on percussion, be found increased either to the right or to the left, and the shadow of the heart will, on Roentgenexamination be seen larger either to the right or to the left. Even by a Roentgenexamination it will not always be easily distinguished from a pericarditic

¹ Paper read at the meeting of the Dutch Society of Electrolgy and Roentgenology on Sunday May 13th in Amsterdam.

exudate, as ABREU¹ observes among others, and, just as in the case so carefully examined and reported on by PEL² in 1884, a correct diagnosis can often only be made at the post mortem, unless, as in the cases of WESSLER³ and REHBERG,⁴ the form of the shadow differs distinctly from that found in pericarditis, or when, as in the case of SAVY, an abscess with a clear area above the level of the pus is seen beside the heart. However, it is also possible, that the whole space between lung and mediastinal organs is taken up by a large exudate, which then rides "à cheval" on the lung root, as SAVY⁵ expressed it. All these exudates, just as exudates in every other kind of pleurisy, are situated in the pleurae. Perhaps it is not unnecessary to draw the attention to this fact, as the name mediastinal pleurisy is a little misleading. It does not mean an inflammation of the mediastinum itself, but of the pleura that surrounds the mediastinal organs. So far perhaps the name of pericarditis externa, which PEL gave to the encapsulated empyema situated beside the heart, is anatomically not quite correct. When we bear this in mind, it will be evident, that a serous exudate originally situated on the median surface of the lung, thus constituting a serous mediastinal pleurisy, can soon spread over the other divisions of the pleural cavity, when the exudate is not encapsulated. Thus, CHAUFFARD,⁶ when discussing his "pleurésie en bande verticale", talks of the "pleurésie en équerre", the right-angled pleurisy. In the first case the exudate is situated in the posterior mediastinal space along the spinal column and causes a rectangular dullness, and by Roentgenexamination a rectangular shadow will be seen along the spinal column. When this exudate spreads over the diaphragm, it causes the right-angled pleurisy. On the other hand, the mediastinal pleural cavity is connected near the root of the lung with the interlobular pleural fissures. This place has quite correctly been called the "carrefour hilare" by BARJON,⁷ and he describes some cases of exudates in this "carrefour" which usually appear on the Roentgenphoto in the form of a more or less

¹ ABREU, Radiodiagnostic dans la tuberculose pleuro-pulmonaire, Paris, Masson & Cie, p. 102.

² PEL, Ein merkwürdiger Fall von Empyem, Berl. Kl. W. 1884, p. 113.

³ WESSLER, The diagnosis of encysted pleural effusions. The med. clinics of North America. Vol. 4, p. 69.

⁴ REHBERG, Über mediastinale Pleuritis. Mediz. Klinik 1920, p. 1033.

⁵ SAVY, Les pleurésies médiastinales. Progrès médicale 1910. N:o 27, p. 371. DEVIC and SAVY, Les pleurésies médiastinales. Revue de médecine 1910.

⁶ CHAUFFARD, Les pleurésies séreuses médiastinales. Presse méd. 1902, p. 363.

⁷ BARJON, Les pleurésies enkystées de la région du hile. Carrefour hilare de la plèvre. Étude clinique et radiologique. Journal de Radiol. et d'Electr. 1914, p. 177.

round or bean-shaped shadow beside the heart at the level of the root. In most cases he saw this pleurisy extending to form an interlobar pleurisy. In one case only the exudate remained in the original shape, till it found its way to the oesophagus and the pus was vomitted. The true mediastinal empyemata also empty themselves sometimes in this way. Sometimes the rupture takes place in the trachea or in the main bronchus, so that pus is being coughed up (BELOT).¹ The Roentgenologist will gather most of his laurels through posterior mediastinal pleurisy. There the ordinary clinical examinations fails us and diagnosis can be made by Roentgenexamination.

I will not tire my readers by giving a complete survey of the literature. Just to show that this case is worth reporting, I will only mention that altogether I have been able to find 26 cases in the literature, of which 19 French ones, 4 German ones, including that of the Dutchman PEL, which appeared in the Berl. Kl. W., and 3 American ones.

Of the different localities where the exudate may possibly appear the posterior mediastinal space is, also according to SAVY, the most rare. On perusing the literature on this subject, this becomes all the more evident and therefore there were all the more reasons for me to give a report on the following case:

It relates to a 58 years old unmarried lady, a patient of Dr FELTKAMP, the director of the "Luthersche Diaconessen Inrichting" in Amsterdam. To his kindness I owe many clinical data. She had a long period of suffering behind her. Since her 20th year she has been suffering from violent attacks of gall-stone colic, for which in her 28th year she underwent a cholecystotomy. From this operation she got a biliary fistula which emptied all the gall from the body. The symptoms of osteomalacia which appeared after three years in consequence of this, are interesting from a general pathological point of view, but have no bearing on this present case. In 1903 this symptoms of osteomalacia made another operation necessary, when the gall-bladder was removed, and in 1911 she had again to be operated for gall-stones. I just mention this, as the precedent condition may be of interest in order to explain subsequent events. Six years ago she began to cough, an unpleasant dry cough which appeared in a sort of paroxysms and tortured her very much. At such a serious fit of coughing she suddenly felt, 2 1/2 months ago, a violent pain in her left side and shoulder. From that moment she had to stay in bed, suffered from pains in her left side, especially when she had a coughing fit, and had every day a rise in her temperature in the afternoon, sometimes over 104° F. Where no symptoms had been found before, a pleuritic exudate was now detected posteriorly on the left side, measuring 3 fingers' breadth. It then struck Dr FELTKAMP that the dullness was less at each inspiration and rose again at each expiration,

¹ BELOT, Pleurésie médiastinale. Bull. et mém. de la Soc. de Rad., March 1914.

which fact together with the precise lateral limitation argued for the exudate being encysted. By puncturing, some clear fluid was obtained. Later on when the patient was taken up in the "Luthersche Diaconessen Inrichting" she exhibited, posteriorly on the left side over the diaphragm, a change in the percussion sound over an area the size of the palm and reaching upwards to the 8th dorsal vertebra. Mesially the spot was bounded by the spinal column, and there was a moderate dullness of the pulmonary sound. In a smaller degree it continued upwards along the spinal column, so that a dull zone extended along the spine. The form of this dull area was more or less triangular. More peripherally the percussion note over the lowest palm-sized area was clearly tympanitic, such as is heard on percussion over the intestines. On deep inspiration this tympanitic area became smaller and the dulled portion extended laterally. On the tympanitic area the coin test was positive, the respiratory sounds were hardly audible, the vocal fremitus and the bronchophony slightly weakened. No succussio Hyppocratis. When the patient was lying on her back and supported under the shoulders and pelvis, the entire dullness and tympanitic note disappeared and was replaced by the common pulmonary percussion note.

This very peculiar case was evidently difficult to interpret. It was most like an encapsulated pneumothorax, even as regards its peculiar manner of origin. But a more exact diagnosis could not yet be made. The Roentgen examination was anxiously looked forward to and gave the following results:

On fluoroscopy the heart appeared to be retracted to the left. On account of this it was difficult to determine the position and mobility of the left part of the diaphragm. The mobility appeared to be sufficient. The sinus phrenico-costalis was absolutely free. The shadow of the heart was intersected by a triangular shadow which had its top at the root of the left lung at the same level as the top of the triangular dull area at the back, its base on the diaphragm and was, judging from the paralax, situated behind the heart shadow.

All this may be seen quite clearly on the photos which I took when the patient was in a lying or sitting posture with her chest or her back to the plate (plate I). The position and the nature of the shadow is seen most clearly on the photo taken of the patient sitting with her back towards the plate and her left shoulder towards the examiner, in the "oblique postérieure gauche" of the French, the left posterior oblique position. Here the shadow behind the heart is distinctly visible (plate II). I want to call the attention to a light spot in the lower portion of the shadow just above the diaphragm, which spot however is less distinct on the reproduction than on the original negatives. The retraction towards the left shows that we are dealing with a fairly old inflammation, and it seems most plausible that the pleura is much thickened. An encapsulated pneumothorax is not absolutely necessary to explain the phy-

sical phenomena. One might possibly assume a strong local relaxation of the lung, but then neither the high pitched tympanitic note nor the coin test is explainable. But at the subsequent puncture the following was observed: the introduced needle, when left to itself, made lateral movements which were produced by the respiration, the point moving towards the median line at each inspiration. On introducing the needle deeper, some c. c. of clear fluid were aspirated first and then a large quantity of air, ± 100 c. c. After the puncturing the tympanitic note had disappeared and given way to a relative dullness. We must therefore assume that there existed an encapsulated mediastinal sero-pneumothorax surrounded by a thickened pleura, over which the lung glides at each inspiration, and thus the decrease in the tympanitic note on inspiration and the peculiar movement of the needle may be explained.

Also when the patient is lying on her back the lung seems to unfold behind the sero-pneumothorax and to give a normal percussion sound. The peculiar shadow was not diminished after the puncture had been made. In the photo which was then taken in the oblique posterior position, only the light spot at the basis is missing, and I do not think it is too daring to conclude that something was here seen of the air-containing cavity.

As to the etiology, we would rather think of the organs beneath the diaphragm. The disease began very likely as a circumscribed pleurisy on the diaphragm and in the posterior mediastinum, and I rather believe, that at one of the coughing paroxysms a small rupture of the lung has taken place and has caused a local pneumothorax. When roentgenographed in an oblique direction it is, however, only visible on the lower side of the shadow, owing to the thickened pleura and its position behind the heart. This diagnosis is confirmed by the physical examination and by the result of the puncture.

Clinically it may be observed that a posterior mediastinal pleurisy may give rise to special symptoms through pressure on the different organs situated in the posterior mediastinum. Especially DIEULAFOYE¹ pointed to this and described the "syndrome mediastinal" in this disease. Difficulty in swallowing, hoarseness, venous engorgements, with formation of collateral circulation, are possibly produced by pressure on the great veins, and a paroxysmal cough by pressure on the vagus. This latter was seen in our case. DIEULAFOYE also described the "submatité juxta-rachidienne", which in the case

¹ DIEULAFOYE. La pleurésie médiastinale, syndrome médiastinal. Clin. med. 1898—99, and Pleurésie médiastine à pneumococques. Presse méd. 1896.

of our patient was seen beautifully as a triangular dullness close to the spinal column. The pain in the "gouttière costo-vertébrale" did not appear until after the second puncture, but disappeared again after a few days.

We may ask now, if after all, a diagnosis without a Roentgen examination would have been possible? When we find the typical "pleurésie en bande verticale" of CHAUFFARD or his "pleurésie en équerre" we may consider the existence of a posterior mediastinal pleurisy. Only the Roentgen examination procures certainty.

Finally, I want to point to a peculiarity, viz. to the more or less triangular shape of the shadow. In the "pleurésie en bande verticale" of CHAUFFARD we think of an exudate parallel with the spinal column. In the book of ASSMANN¹ we find a drawing of a Roentgen photo of a similar case. Such an exudate must be situated farther back in the posterior mediastinal space. If, however, it is situated somewhat more forward, its upper portion must meet the root of the lung and its shape become triangular. Thus, its shape is determined by its anatomical position.

Mostly the mediastinal pleurisy, which is generally an anterior one, is only a complication either of a more extensive purulent pleurisy or of an advanced tuberculosis of the lungs. I have not been able to find in the literature a case such as this one, where there is only a posterior mediastinal pleurisy.

SUMMARY

Discussion about the different localities where encapsulated exudates of the mediastinal pleura may possibly occur. Report on a case of mediastinal seropneumothorax in a woman of 58 who from her 20th year suffered from gall-stones, which necessitated three operations. The remarkable results of percussion are discussed. The Roentgenological examination showed, that there was a triangular shadow behind the heart, showing a clear portion at its base, disappearing after about 100 c. c. of air had been aspirated by puncture. Discussion about the different forms of posterior mediastinal pleurisy.

ZUSAMMENFASSUNG

Es werden die verschiedenen Lokalisationsmöglichkeiten eines abgekapselten Exsudates im mediastinalen Pleuraraum besprochen. Der Fall wird mitgeteilt einer 58-jährigen Dame, die seit ihrem 20^{sten} Jahre an Gallenstei-

¹ ASSMANN, Die Röntgendiagnostik der inneren Erkrankungen. Leipzig, F. C. W. Vogel 1921.

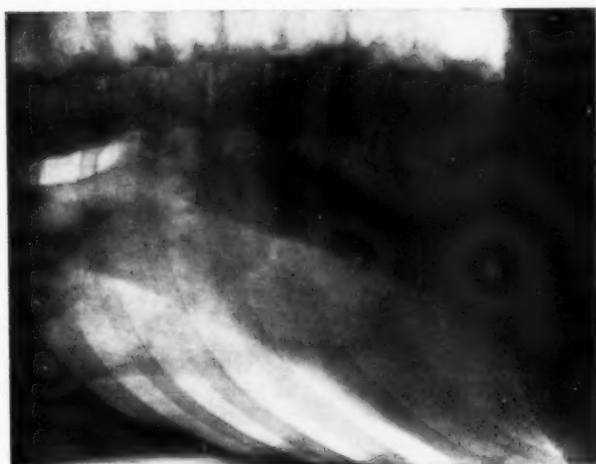
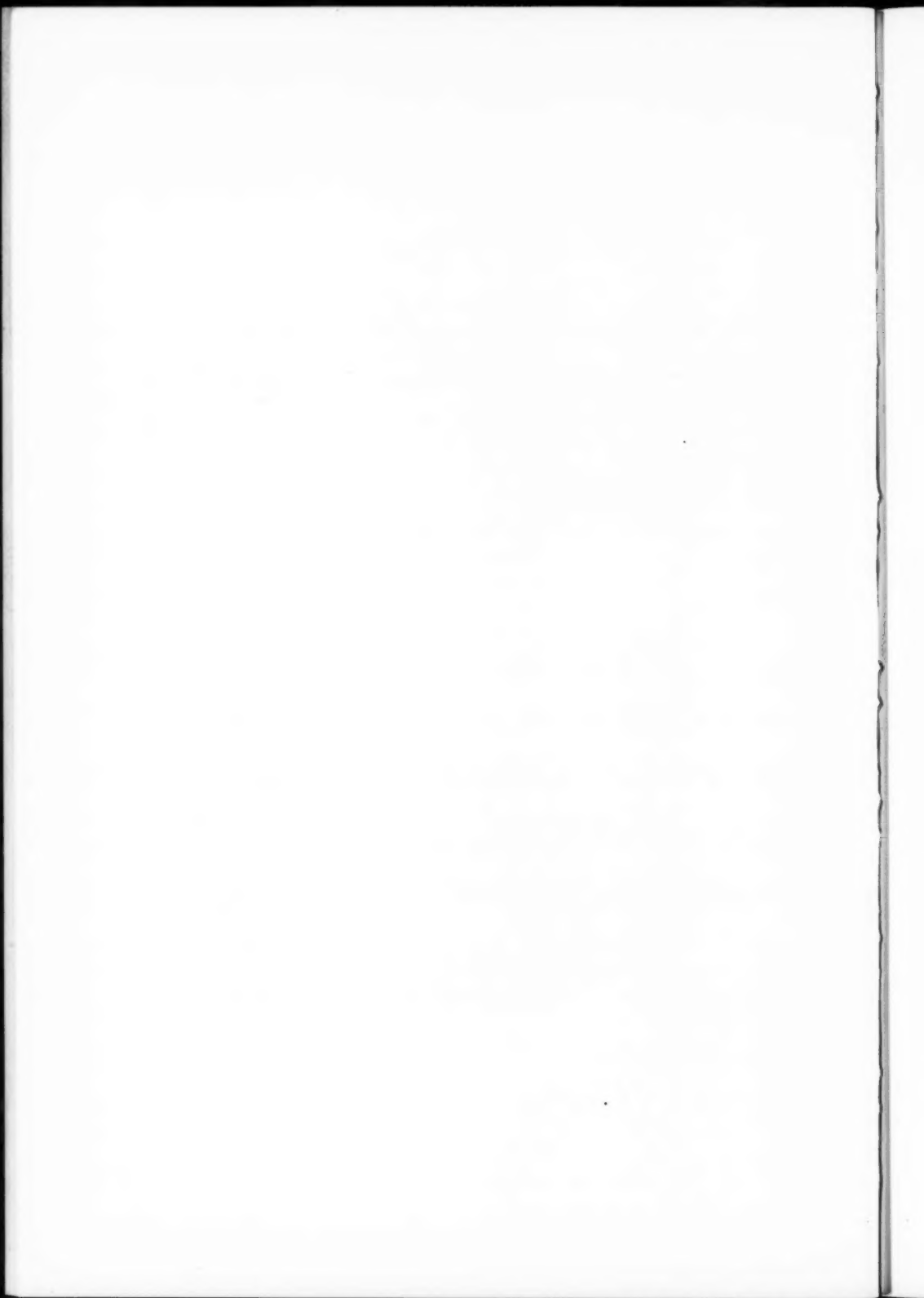


Plate II.



Plate I.



nen gelitten hat und drei Operationen durchstand, und bei der sich ein abgekapselter Seropneumothorax mit eigentümlichem Perkussionsbefund entwickelte. Röntgenologisch fand man einen dreieckigen Schatten hinter dem Herzen mit einer Aufhellung an der Basis, die später, nachdem bei der Punction ca 100 cc. Luft aspiriert wurden, verschwunden war. Die verschiedenen Formen der Pleuritis mediastinalis posterior werden besprochen.

RÉSUMÉ

Discussion des localisations différentes des exsudats encystés de la plèvre médiastinale. Communication d'un cas de séropneumothorax encysté chez une femme de 58 ans qui dès sa vingtième année souffrait de cholélithiase qui nécessita trois opérations. Les résultats remarquables de la percussion sont discutés. L'exploration röntgenologique montra une ombre triangulaire derrière le cœur avec une partie claire à sa base qui disparaissait après l'aspiration par ponction de circa 100 cc. d'air. Discussion des différentes formes de pleurésie médiastinale postérieure.



A CONTRIBUTION TO THE ROENTGEN DIAGNOSIS OF ULCUS PEPTICUM JEJUNI

Read at the 3rd Meeting of the Nordisk Förening för Medicinsk Radiologi at
Stockholm June 1923

by

S. Ström †

(Tabulæ XX—XXI)

Judging from the large works on the roentgenologic diagnosis of the diseases of the alimentary canal it seems as if the opinions were rather vague about the roentgenologic signs of ulcer pepticum jejuni. In the last few years I have had the opportunity to make some series of post-examinations of patients operated for ulcer, totalling about 300 examinations. From these and from my practice I have collected some cases of this relatively rare complaint. From these cases I have formed the opinion that there are certain local signs of these ulcers that are analogous to the ulcer signs in the stomach and duodenum, on the basis of which one is sometimes able to make a precise diagnosis of ulcer. The importance and nature of these local signs do not seem to have been sufficiently emphasized before.

Since Professor J. BERG reported on the first case of peptic jejunal ulcer at the Congress of the Northern Surgical Association in Christiania in 1897, quite a number of papers on this subject have appeared in the literature, most of them from surgical quarters. The statements vary considerably as to its frequency after simple gastro-enterostomies, but keep generally at about 2—5 %. It seems to be more frequent after gastro-enterostomy with exclusio pylori or owing to an organic pyloric stenosis, and more rare after canalisation with gastro-enterostomy.

A peptic jejunal ulcer does not differ from a gastric or duodenal ulcer in a pathologic-anatomical respect. Thus, there are simple, callous, perforating or penetrating ulcers. For conveniency one distinguishes between gastro-jejunal ulcers, which start in the gastro-enterostomy opening, and jejunal lesions. Yet, it is not uncommon

to find an ulcer in the efferent jejunal loop; it is more rarely seen in the afferent one. A jejunal ulcer has been found at a distance of as much as 30 centimetres from the gastro-enterostomy opening (Wendt).

A peptic jejunal ulcer may penetrate in different directions: into the mesenterium, into the anterior or posterior abdominal wall, forming in the latter case a retro-peritoneal recess, and finally into the colon, thereby establishing a direct communication between the stomach or the jejunum and the colon.

From the pathologic anatomy of the *ulcus pepticum jejuni* we may probably expect roentgen pictures resembling those of the gastric and duodenal ulcers. The intestinal wall in the jejunum has, as we know, principally the same structure as the stomach wall, with that difference, however, that the mucous folds are transverse instead of longitudinal. This gives the jejunal contour on the roentgen picture a different appearance. The unevenness normally observed in the jejunal contour renders it, of course, to some extent difficult to recognize niche-formations.

In his well-known work on the roentgen diagnosis of the diseases of the alimentary canal CARMAN reviews several publications on the peptic jejunal ulcer and gives a very meritorious account of this complaint, illustrated by numerous cases. He classifies the roentgenologic symptoms as indirect and direct signs, or such that broadly indicate an abnormal condition, and such that point directly to the location of the change. To the former group belong: the six-hour retention, hyperperistalsis, dilated stomach, dilatation of the duodenum, and spasticity of the stomach. To the latter group he refers: deformity around the gastro-enterostomy opening, narrowing and irregularities in the jejunum, scanty flow of barium through the stoma, and fixation of the stomach at the site of the stoma. CARMAN does not, however, attach very much importance to the niche symptom. He says, that he has only once seen a niche resembling a gastric ulcer. He explains this as being due to the nature of the lesion, which prevents it from appearing as a niche, as the lesion is superficial more often than it is deep.

Some few authors, for instance HAUDEK, do, however, emphasize the importance of the niche symptom in the diagnosis of peptic jejunal ulcer. In one of the last numbers of *Journal de Radiologie et d'Électrologie*, BÉCLÈRE has described a case of a niche-formed peptic jejunal ulcer, illustrating it by fine pictures.

I want especially to draw the attention to the importance of the direct symptoms, the niche and the spasm. With regard to the niche-formation it ought to be pointed out that the niche in the gastro-enterostomy opening may be difficult to notice, when it is so

located that the stomach contents pass in front of or behind it. It is equally difficult when the ulcer is situated anteriorly or posteriorly in the jejunum. Otherwise a callous ulcer with crater in the jejunum does not, as far as the roentgen picture is concerned, differ very much from a similar gastric ulcer.

There are also some roentgen-diagnostically important, spastic symptoms in connection with the peptic jejunal ulcer. There is partly a contraction of the circular muscles towards an ulcer in the jejunum, analogous to the spastic constriction found in connection with gastric and duodenal ulcers, and partly a spasm which may be localized chiefly to the muscularis mucosæ. This is the reason why the mucous membrane in the neighbourhood of the ulcer shows a smooth contour without any folds. In callous ulcers there can also be some indurative changes in the surroundings, which changes cause an obliteration of the folds. It should also be remarked that BLAND-SUTTON has in one case found the mucous membrane and the muscularis mucosæ immediately surrounding a jejunal ulcer to be abnormally thin, devoid of valvulæ conniventes and resembling very much the mucous membrane of the bulbus duodeni. DAHL has, on the other hand, in one case found the folds to be hypertrophic and the whole of the mucous membrane swollen and edematous, which fact may also explain why the digestive chambers between the folds do not fill.

From my experience, I do not consider the indirect signs above mentioned to be of any high value. Of course it is very important, if signs of stenosis in the gastro-enterostomy opening can be definitely proved, but a stenosis is far from being present always, even if the ulcer is situated in the stoma (DAHL). A residue, again, is not unfrequently present in the stomach, distal to the gastro-enterostomy opening, if the position of this is disadvantageous to the emptying of the stomach, without, however, being indicative of ulcer. The gastric peristalsis is generally fairly weak in gastro-enterostomy stomachs, as the stomach empties chiefly through the gastro-enterostomy opening. The peristalsis is of a sure diagnostic value only if it is of a stenotic character.

I shall now illustrate by some typical cases what I have said about the roentgen picture of peptic jejunal ulcers.

Case I.

A 14-years-old girl, who was admitted to the Umeå Hospital Nov. 11th 1922. Four years previously she had been operated on a stenotic ulcer of the pylorus, a posterior gastro-enterostomy being then made. She exhibited no symptoms for half a year, when she again began to feel pains after partaking of unsuitable food. During the last six months the pains had increased and she had had occasional vomitings.

Clinical examination: Abdomen soft, not tender. Free HCl 46. Weber's test negative.

Roentgen examination (Fig. 1): Stomach of ordinary size, canalis somewhat dilated. Rapid emptying through the gastro-enterostomy opening. At the first examination a condition of increased contraction was observed on the efferent loop immediately below the gastro-enterostomy opening. At the examination which was made two hours later, when most of the meal had been evacuated, the patient was given a further two-hundred grams of barium meal. The serial plates which were then taken, revealed a niche-like and very dense shadow just at the site of the stoma (Fig. 2). No pressure-tenderness here.

Operation (Dr. MICHAELSSON): A crater-shaped peptic ulcer in front, just opposite the gastro-enterostomy opening. It is bounded posteriorly by the mesocolon which is indurated in the neighbourhood of the ulcer. The efferent gastro-enterostomy loop is edematous.

Case II.

Physician, aged 57. Symptoms of gastric ulcer since 1906. Operation on February 12th 1919 (DAHL): Ulcer a little larger than a threepenny piece on the lesser curvature at the angulus ventriculi. A strip 3—4 centimeters broad was removed and the stumps joined up end to end.

The immediate course of healing was excellent, but fresh symptoms of ulcer appeared after three months. A roentgen-ray examination revealed a large niche in the suture line. On examination of the highly acid stomach contents after a test breakfast the total acidity was found to be 68.

New operation on May 22nd 1919: large ulcer on the posterior surface of the stomach in the line of the suture and close to the lesser curvature. A segment was removed just as at the previous operation. There was now some difficulties in joining up the lumina, and therefore the lower one was closed and the upper one made to anastomose terminolaterally with the jejunum. The lower stump of the stomach was fairly large.

The patient was quite well during the next months and increased in weight considerably. The stomach contents showed now a diminished acidity: Free HCl 14, total acidity 30. After a year and a half he again began to feel pains, at first slight and then violent.

Roentgen examination: Niche-shaped ulcer quite the size of a bean on the efferent loop of the jejunum just below the gastro-enterostomy opening. Spastic incisura in the jejunal loop opposite the niche. The folds in the neighbourhood of the niche are obliterated (Fig. 3).

Operation: A deep crater-shaped ulcer in the jejunal loop corresponding to the niche. The jejunal loop with the ulcer was removed, and a fresh termino-lateral gastro-jejunostomy was made, besides which the pyloric stump of the stomach was removed.

The patient has since then been quite well. On different occasions during 1921 the stomach contents showed anacidity.

Case III.

Male, aged 39, was operated on duodenal ulcer in 1918. After a year he again felt pains in the lower region of the abdomen and noticed blood in his stools. Was for two months treated internally for ulcer. Toward the

end of the year he was treated for ulcer again, owing to the symptoms reappearing. Has since then repeatedly felt pains in the umbilical region, the pains extending down towards the bladder and becoming less severe after meals. Had heavy bleedings some months ago. Came to the Umeå Hospital on August 28th 1922.

Clinical examination: Abdomen soft, pressure-tenderness round the umbilicus. Free HCl 23, total acidity 51. Weber's test negative.

Roentgen examination (Figs. 4 and 5): The stomach emptied fairly quickly through the efferent gastro-enterostomy loop. Periodically a strong narrowing appeared in the proximal end of this loop. A shadow resembling a niche is seen in this region on serial plates. Pressure-tenderness over the point of this shadow. After two hours there is a residue at the gastro-enterostomy place and in the canalis, the niche is filled, its shadow being sharply outlined and dense.

The patient refused operation.

Case IV.

Male, aged 21. Operated on the Umeå Hospital on June 17th 1922 for duodenal ulcer (two ulcers, one of them penetrating into the pancreas). Resection of the canalis and gastro-enterostomy was performed. Was then quite well until the middle of November, when he began to feel an aching pain in upper left region of the abdomen. Was admitted to the Umeå Hospital on December 4th 1922.

Clinical examination: Abdomen soft, no resistance. Fairly great pressure-tenderness over an area to the right of and on a level with the umbilicus. Free HCl 0. Total acidity 24.

Roentgen examination (Figs. 6 and 7): The vertical portion of the stomach is somewhat bulky; canalis removed. Fairly rapid emptying through the stoma. A portion of the efferent loop is contracted a few centimeters below the place of the gastro-enterostomy. That side of the jejunal loop situated next to the stomach does not fill in the normal way in this region, the valvulae being here obliterated.

The patient was for four weeks treated internally for ulcer and was discharged free from symptoms. Three months later he was reexamined; the roentgen examination then showed a rapid emptying and a greatly distended efferent loop without local narrowing (Fig. 8).

The spastic deformity in the jejunum is in this case quite unmistakable. Corresponding to this deformity there is possibly in the jejunal shadow a niche the size of a pin's head. A peptic jejunal ulcer is rarely found after a canalis-resection, it is true, but we know that the canalis-resection does not preclude the possibility of a peptic jejunal ulcer, and some cases of peptic jejunal ulcer are known which have been unacid before the operation (TIEGEL, KEY). As is quite well known, one can not draw definite conclusions only from one determination of the acidity, as the acidity may vary from one day to another. At the re-examination which was made half a year later the patient in question had free HCl in his stomach.¹

¹ The patient is later (June 1923) operated on a peptic jejunal ulcer of the efferent jejunal loop 3 cm from the stoma.

Case V.

Male, aged 25. Operation on July 21st 1922, when gastro-enterostomy was made as well as excision with cauterization of a duodenal lesion according to the method of Balfour.

February 1st 1923: The patient has felt aching in the upper region of his abdomen, gets sometimes a chill during his work.

Clinical examination: Abdomen soft. Free HCl 52, total acidity 74.

Roentgen examination (Figs. 9 and 10): The shape of the stomach somewhat bulky. The emptying took place through both the stoma and the duodenum. Narrowing of the efferent loop, suspicious niche shadow on the medial side of this loop. The valvulæ on this side almost obliterated in the narrowed area.

The patient was for three weeks treated internally for ulcer and then became free from symptoms. The roentgen examination showed then a diminished contraction of the efferent loop, no suspicious niche shadow.

In consequence of these cases I think I may safely draw the conclusion that direct ulcer symptoms can not unfrequently be proved in cases of ulcer pepticum jejuni. I was further strengthened in this opinion of mine by CARMAN's excellent pictorial material with roentgen plates of operated cases. He has obtained from the Mayo Clinic a very great material of 69 cases of ulcer pept. jejuni examined by roentgen. In two of these extraordinarily fine plates there is, as it seems me, a typical niche in the jejunum just in the vicinity of the stoma, and in four plates, a niche-resembling shadow in the stoma itself. I venture to say that CARMAN, aware of the variety of pictures that the jejunal loops may give, has been too sceptical with regard to the niche symptom.

In the pictures of BÉCLÈRE's before-mentioned case one meets with the smooth contour of the jejunum, without any valvulæ, in the vicinity of the lesion, which condition is also seen in my cases II and IV.

In conclusion I want to say a few words about the technic. In these examinations one ought above all to employ serial radiography. The pictures of the jejunum are varying, so much that it is necessary to prove a constant deformity by several plates. In case of an ulcer of the stoma or of the anterior or posterior wall of the jejunal loop it has furthermore proved useful to make a second examination one or two hours after the first one, when most of the stomach contents have been evacuated. The patient has then been given a second opaque meal, and I have thus been able to ascertain the location, in relation to the gastro-enterostomy opening and the jejunal loops, of any residue which may remain from the previous meal, and which may have been suspected to be a niche. In this

manner I have sometimes obtained a niche shadow which I was not able to see at the first examination. (Cases I and III.)

A pressure applied in a suitable way may also make the observation of a niche easier.

SUMMARY

1. The importance of the niche symptom to the roentgen diagnosis of the peptic jejunal ulcer is undoubtedly underrated. One may sometimes succeed in proving a niche in cases of both gastro-jejunal and jejunal ulcers.

2. It seems to be a typical feature that the jejunum displays a smooth and somewhat retracted contour in the surroundings of an ulcer. This roentgenologic feature is sometimes caused by a spastic contraction, probably of the muscularis mucosae. Organic changes in the intestinal wall may, however, also be a contributory cause of this feature.

Further, there is a contraction of the circular muscles of the jejunum towards an ulcer, analogous to the spastic constriction seen in gastric and duodenal ulcers.

3. Serial radiography facilitates the observation of these direct signs of ulcer.

ZUSAMMENFASSUNG

1. Die Bedeutung des Nischensymptoms für die Röntgendiagnose des peptischen Jejunalgeschwürs wird zweifellos unterschätzt. Sowohl in Fällen von gastro-jejunalem als von jejunalem Ulkus gelingt es mitunter eine Nische nachzuweisen.

2. Es scheint ein typisches Merkmal zu sein, dass das Jejunum in der Umgebung eines Ulkus eine glatte und etwas retrahierte Kontur zeigt. Dieses röntgenologische Symptom ist manchmal durch eine spastische Kontraktion, wahrscheinlich der Muscularis mucosae, verursacht. Organische Veränderungen in der Darmwand mögen gleichwohl eine beitragende Ursache zu dieser Erscheinung sein.

Ferner findet sich eine Kontraktion der zirkulären Muskeln des Jejunums gegen das Ulkus zu, analog der spastischen Konstriktion, die bei Ulcus ventriculi und duodeni zu sehen ist.

3. Röntgenologische Serieaufnahmen erleichtern die Beobachtung dieser direkten Ulkussymptome.

RÉSUMÉ

1. L'importance du symptôme de niche pour la diagnose radiologique de l'ulcère peptique du jejunum est sans doute estimée trop peu. Il est parfois possible de constater des niches dans des cas d'ulcères gastro-jéjunales ou jéjunales.

2. Il semble être assez typique que le jejunum montre un contour mou et quelque peu rétracté près d'un ulcère. Cette image radiologique est par-



Fig. 1.

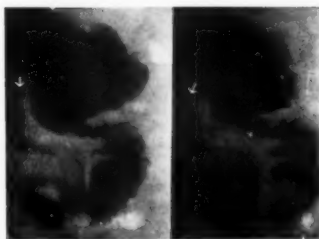


Fig. 2.

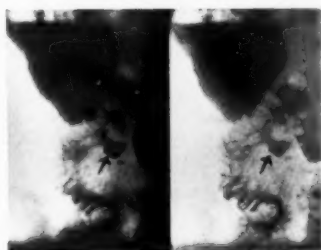


Fig. 3.

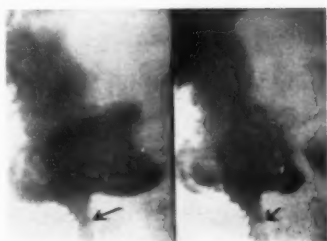


Fig. 4.

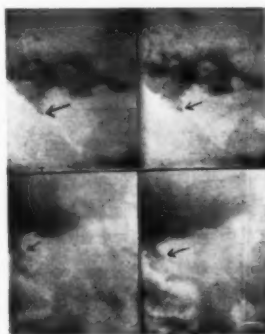


Fig. 5.



Fig. 6.

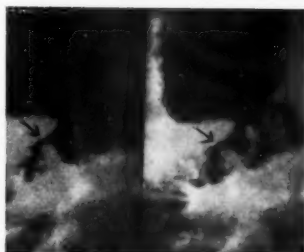


Fig. 7.

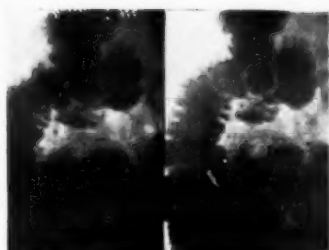


Fig. 8.

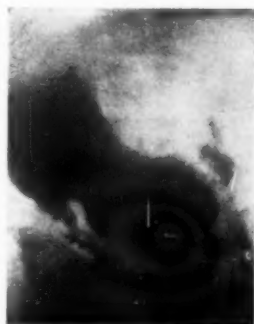


Fig. 9.

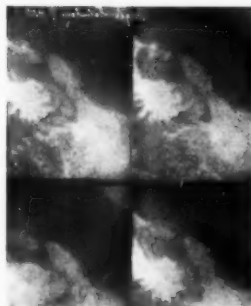


Fig. 10.



fois dûe à une contraction spastique, probablement de la muscularis mucosae. Pourtant des changements organiques peuvent aussi contribuer à provoquer cette image.

En outre il y a une contraction des muscles circulaires dans le jéjunum autour d'un ulcère, analogue à la contracture spastique trouvée chez des ulcères de l'estomac et du duodénum.

3. Des images radiologiques en séries facilitent l'observation de ces signes directes d'ulcères.

REFERENCES

- BÉCLÈRE: Journ. de radiologie et d'électrologie, Vol. 7, No. 4.
 BLAND-SUTTON: Britt. med J. 1916, pag. 272 (cit. after R. Dahl).
 CARMAN: The roentgen diagnosis of diseases of the alimentary canal.
 DAHL: Acta chirurgica Scandinavica, Vol. 52, No. 6.
 FORSELL: American Journ. of Roentgenology 1923, No. 2.
 FRENZ: Berl. kl. W. 1918, pag. 1020.
 GOETZE: Grundriss und Atlas der Röntgendiagnostik der inneren Medizin.
 Hrsg. von Fr. M. Groedel. III. Auflage. München 1921.
 KEY: Cit. after Dahl.
 HADEK: Münch. med. W. 1918, pag. 854.
 MILLS: Amer. Journ. of Roentgenology, 1922, No. 4.
 WENDT: Beitr. z. klin. Chir. 1914 (cit. after Dahl).
 ZOLLSCHAN: D. med. W. 1918.



DIVERTICULA OF THE STOMACH FROM A ROENT- GENOLOGICAL POINT OF VIEW

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by

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(Tabulæ XXII—XXV)

In contradistinction to other kinds of recess formations of the stomach the term diverticulum of the stomach refers — as we know — to a circumscribed, more or less rounded, pocket- or bag-shaped, mucosa-covered protrusion from the lumen of the stomach.

It is extremely rare to find any statements as to diverticula of the stomach in the roentgenological literature.

Most of the observations made in this respect relate to so-called »functional diverticula of the stomach». Several authors, as for instance DE QUERVAIN, STIERLIN and SCHLESINGER, have characterized by this name such cases of diverticula, in which at the post-mortem examination of the stomach one has not been able to find any anatomical cause for a roentgenologically ascertained diverticulum of the stomach. The different authors have therefore presumed a purely functional basis for the diverticulum: DE QUERVAIN has imagined a diminished tonus, a paresis or paralysis of a circumscribed area of the stomach wall, which therefore curves outwards «like a thin-worn spot on an inflated rubber ball»; SCHLESINGER, on the other hand has presumed a condition of locally increased contraction, a «tangential spasm», whereby a limited portion of the stomach becomes shut off from the rest of it.

Several years ago I asserted as my opinion on the basis of first one, and later on of several quite analogous observations, that all cases published on so-called «functional diverticula of the stomach» have concerned true anatomical diverticula, originating from the terminal portion of the duodenum situated behind the stomach, or from the region of the duodenojejunal flexure, which diverticula of

the small intestine had been misinterpreted at the roentgenological examination as belonging to the stomach.

A careful observation of the relations between the stomach and the diverticulum as to their moveableness and filling-up, as well as a close study of their contours and an examination at an oblique or quite «lateral» projection, ought no doubt to be sufficient to determine the true nature and point of origin of the diverticulum in such cases.

SCHLESINGER himself as well as other authors, e. g. SCHINZ, ZEHBE and ROTHBART, have later agreed with the opinion which was first advanced by me, that the cases published on «functional diverticula of the stomach» have unquestionably been duodenal or jejunal diverticula, which have simulated diverticula of the stomach. Therefore, it seems to me that there is no reason still to adhere to the term «functional diverticula of the stomach» in the above-mentioned sense.

Statements as to *organically pre-formed diverticula of the stomach*, being still very rare in the pathologic-anatomical literature and still more so in the roentgen literature, I have thought that a short report on a series of such cases, which I have had the opportunity to observe during the last years, might be of some interest, not only from the point of view of curiosity but far more from a differential-diagnostic standpoint, especially as in my opinion cases of this kind are by no means so exquisitely rare as one generally seems to suppose.

First of all I shall, however, give an abridged account of that which from a roentgenological point of view is most interesting as regards the pathological anatomy of the diverticula of the stomach, and also in just a few words report what I have come across in the roentgen literature with regard to the diverticula of the stomach.

One can apparently distinguish between two main groups of diverticula of the stomach: 1) the so-called «*congenital*» diverticula, i. e. those existing from birth or those which have gradually developed owing to a congenital disposition or to a congenital anomaly, and 2) those *acquired* from various causes.

The «*congenital*» diverticula seem to have a predilection for two places particularly, partly in the neighbourhood of the cardia, partly within in the pyloric part of the stomach, more or less in the proximity of the pylorus itself. Especially the first-mentioned location seems to be most common, and the diverticula are situated just behind the cardia. A whole series of cases with this location have been described: KEITH 2 cases, ZAHN 1 case, HIRSCH 1 case, HANDTMANN 1 case (fig. 1). At a post-mortem examination some years ago I have myself observed a diverticulum having that position.

The congenital diverticula seem not unfrequently to attain the size of a cherry or of a pigeon's egg; diverticula of the stomach the size on a plum or even larger have also been described. The entrance to the diverticulum is often sharply defined and circular.

Usually the wall of these diverticula consists of all the different coats of the stomach: mucosa, muscularis and serosa. The mucous membrane is, however, sometimes very thin and atropic, the musculature is as a rule very slightly developed and may also be completely lacking.



Fig. 1.

In connection with the histological structure it may perhaps be worth mentioning that on microscopic examination pancreatic tissue has been found disseminated in the wall of the diverticulum in some few cases (FALCONER, KOLACZEK, NAUWERCK). NAUWERCK is inclined to see in these accessory pancreatic germs which moreover occur physiologically in the animal series, an etiological explanation of such congenital diverticula, which he therefore calls «pancreatic diverticula». According to the view expressed by IVAR BROMAN diverticula with or without pancreatic tissue are only unequally reduced pancreatic germs; diverticula without any pancreatic tissue

would then originate when only the system of ducts has been developed. The «appendices pyloricae» of certain fishes, which may contain remains of pancreatic tissue, are surely to be conceived as a physiological analogy to these pancreatic diverticula.

KEITH states that diverticula in the cardiac region are normally found in certain mammals, e. g. the pigs, and points out that just the cardiac portion of the human stomach is normally developed as a kind of diverticulum of the foregut.

The *acquired* diverticula of the stomach are due to very many and various causes and have an extraordinarily varied location. Among the causes one finds *pressure* of swallowed voluminous foreign bodies, e. g. hair tumours (Schultén), different kinds of *traumata* which have brought on a rupture of the muscular coat (Zahn) — post-operative diverticula belong here, too — different kinds of *tension* and *traction* of certain circumscribed, more or less fixed portions of the stomach, so-called traction diverticula (THOREL, TILGER, HEUBEL, KOLACZEK, JONES, VON HANSEMANN).

One of the two statements I have found in the *roentgen literature* as to organic diverticula of the stomach, originates from the well-known work of CARMAN on the roentgen diagnostics of the alimentary canal. It relates to a case of a juxtapyloric diverticulum on the greater curvature of the stomach and situated just opposite a callous gastric ulcer on the lesser curvature. The roentgen diagnosis was duodenal ulcer; the diverticulum had not been roentgenologically proved. It is probably impossible to decide in this case which one of the changes, the diverticulum or the ulcer, is the primary one.

The second roentgenological observation of a «true diverticulum of the stomach» is of a quite recent date, having been published in the last number of the «Fortschritte auf dem Gebiete der Röntgenstrahlen» (April 1923) by LADISLAUS ROTHBART (Budapest). It is a case of a bag-shaped protrusion the size of half a wal-nut on the greater curvature in the central portion of the corpus of the stomach. The diverticulum as well as the rest of the stomach was well movable and did not exhibit any tenderness to pressure. The case was not operated upon and has unfortunately not been verified.

My own material comprises 5 cases: four of them belong to the type of congenital diverticula in the cardiac region, the fifth one is a post-operative diverticulum within the canalis.

I shall just give a brief report on these cases:

Case 1.

Female teacher, aged 29, suffering from periodic ulcer troubles since many years. At the *roentgen examination*, 7/12/1920, a typical ulcer defor-

mity of the bulbus was found; a niche formation the size of a hemp-seed on the retracted side of the lesser curvature of the bulbus with a corresponding, nicely rounded spastic stricture.

Just above the cardia there was an oval and well-defined recess the size of a brown bean, originating from the medial wall of the fornix. (Fig. 2 and 3.) This recess exhibited during the examination a varying degree of distention and filling. In erect posture the contrast meal collected in the lower portion of the diverticulum and had a sharp horizontal upper limit and above the contrast filling there was an obvious gas bubble in the diverticulum. After 4 hours a pea-sized contrast spot was seen in the diverticulum, the stomach being otherwise empty.

Case 2.

A married woman, aged 53, with flatulence troubles of many years' duration, at times pains in the epigastrium, nervous. No ulcer symptoms were found at the *roentgen examination* on the 27/1/1921. High up on the posterior surface of the fornix, just above the cardiac level, there was a diverticulum almost the size of a plum (Fig. 4); in erect posture this diverticulum was found to be contrast-filled in its lower half, its upper half being gas-filled. The horizontal level of the contrast-filling reached just up to the lower border of the orifice of the diverticulum. On turning the patient sideways this orifice could be beautifully shown and was seen through the gas-bubble in the fornix of the stomach as a well-marked, circular opening with a diameter of $1\frac{1}{2}$ c. m. (Fig. 5.) After 4 hours, when the rest of the stomach was almost empty, the diverticulum was still contrast-filled.

Case 3.

Cook, aged 40, with ulcerous-like troubles during the last few years; melaena on admittance. *Roentgen examination* on the 14/2/1922 revealed an inconstant local spasm high up on the bulbus as well as two diverticula, one the size of a goodish walnut and located on the posterior wall of the fornix just above the cardiac level, the other almost the size of a plum and located on the descending portion of the duodenum in the neighbourhood of papilla Vateri. (Fig. 6.) On rotating the patient sufficiently the diverticulum on the fornix could be projected free to a large extent. (Fig. 7.) In erect posture the contrast mass collected in the lower part of the diverticulum as a crescent-shaped shadow below the gas bubble. After 4 hours there was a moderate residue of the meal in the horizontal portion of the stomach, and a contrast filling both of the ventricular and the duodenal diverticulum.

Case 4.

Married woman, aged 42. In 1915 and 1918 and shortly before admittance she had had hematemesis; repeated cures for ulcer. At the *roentgen examination* which was made on the 29/6/1922 one found a spasmodic stricture on the greater curvature in the upper portion of the corpus, which stricture, however, soon dissolved. A large rounded diverticulum originated from the posterior portion of the medial wall of the fornix and had in erect posture the size of a goodly walnut; in prone position it was, however, distended to the size of a large plum. (Fig. 8, 9, 10.) In erect posture the diverticulum was barium filled only in its lower part. The upper limit of the contrast shadow was horizontal and sharply outlined against the gaseous contents in the upper parts of the diverticulum. After 4 hours the diverticulum was still nicely barium-filled and had in prone position well-defined,

beautifully rounded and smooth contours; in the stomach itself there were only some small barium residues. (Fig. 11.)

Case 5.

Male, aged 57, with periodical ulcer troubles since the age of 25. In October 1917, after a preceeding roentgen examination, the patient had been operated for duodenal ulcer with posterior retrocolic gastroenterostomy and exclusion of pylorus (division). Already after a few months there appeared clinical symptoms of *ulcus pepticum jejuni*. A roentgen examination of the stomach in March 1919 had revealed a change in the contours of the stomach close to the site of the gastro-enterostomy, which was tender to pressure. A lengthy cure for ulcer only resulted in a passing improvement.

At the *roentgen examination* which was now made on the 9/3/1922 the patient exhibited an ulcerous niche at the site of the gastro-enterostomy not quite the size of a six-pence, over which there was a distinctly marked tenderness to pressure (*ulcus pepticum jejuni callosum*).

On the greater curvature within the *canalis ventriculi* at the site of the previously performed division there was now a diverticulum, the size of which varied considerably, and which was connected with the *canalis ventriculi* by a narrow stem with distinct longitudinal folds of mucous membrane. When distended, this diverticulum was circular and larger than a six-pence (Fig. 12); when contracted, it was oval in shape and only the size of a coffeebean. (Fig. 13.) There was no tenderness to pressure over the diverticulum, not even on deep palpation. The diverticulum was seen to be less moveable, and the stomach was at this place somewhat displaced towards the right side. A moderate residue in the ventricle and a contrast filling of the diverticulum after 4 hours. Roentgen diagnosis: *Ulcus pepticum jejuni + diverticulum canalis ventriculi*.

On operation (Dr. ROBERT DAHL to whom I am indebted for kindly placing the record of the case at my disposal) a large gastro-jejunal ulcer was found which partly narrowed the gastro-enterostomy opening and partly kinked the gastro-enterostomy loop, the afferent portion of which was greatly dilated. Resection was done of the portion of the intestine employed for the gastro-enterostomy, of the portion of the stomach supporting the gastro-enterostomy and of the previously excluded portion of the stomach together with the pylorus; fresh termino-lateral gastro-enterostomy. The diverticulum was situated in the excluded portion of the stomach, quite close to the site of the previous division; there was a local defect in the musculature, and the wall of the diverticulum consisted only of the mucous and serous coats.

Although an operative verification has been obtained only in one of the cases (the post-operative diverticulum of the stomach, case 5) which is probably the first case of that kind that has been roentgenologically diagnosed and then verified by operation and finally removed, I do not think there exists any doubt about the diagnosis of diverticulum being correct also in the other cases that have not been autoptically controlled, but all of which exhibited typical pictures of diverticulum.

The soft contour and the varying degree of distention observed during the fluoroscopy, the smooth oval shape of the pocket formations,

and the fact of their being localized to the particular favourite seat of the diverticula of the stomach, where as a rule ulcer niches do not occur, as well as the absence of roentgenological signs of infiltration in the surroundings of the recesses, and in spite of this a 4-hours retention in the recesses, all these things do, in my opinion, justify the roentgenological diagnosis being made without hesitation.

Owing to their position above the margin of the thorax the cardiac diverticula were, naturally, not accessible to palpation and could therefore not be examined as to their tenderness to pressure.

These cases are of the greatest roentgenological interest from a differential-diagnostic standpoint. It is of the utmost importance to be acquainted with the roentgen pictures of the diverticula of the stomach, in order not to make a wrong diagnosis of a penetration cavity originated from an ulcer. On the other hand, one ought to remember that a «posterior fornix-recess» may in some cases offer certain similarities to a true diverticulum of the stomach, and therefore one must always endeavour to project the diverticulum as free as possible by rotating the patient and, to try to study its point of origin in the stomach.

The question of to what extent the diverticula of the stomach is of any clinical importance can not be answered on the basis of this fairly scanty material, especially as several of the cases have not been purely diverticular. However, just as diverticula of the duodenum may be of clinical importance in certain cases, I do not consider it improbable that also diverticula of the stomach may give clinical symptoms under certain circumstances.

Addendum:

During the printing of this paper, my assistant, Dr. G. RENCK, has had two cases of diverticulum of the fornix of the stomach for roentgenoscopic examination, one of them at the Central Hospital of the County of Stockholm, (Fig. 14) the other (Fig. 15—17) at the Provisional Hospital of Stockholm, which cases have very kindly been placed at my disposal.

In both cases one sees a distinct peduncle-shaped connection between the diverticulum and the stomach. The latter case which had undergone at some other place a very long treatment for a large »ulcer niche» of the lesser curvature of the stomach, is a further illustration of the importance, emphasized above, of an exact roentgenologic differential diagnosis between ulcer and diverticulum.

Stockholm, May 1923.

SUMMARY

The scanty statements found in the roentgen literature as to diverticula of the stomach, relate with two exceptions to so-called «functional» diverticula of the stomach, all of which, in the opinion of the author, are misinterpreted diverticula of the small intestine situated behind the stomach and originating from the terminal part of the duodenum or from the region of the duodenojejunal flexure.

The author reports on a series of five cases of roentgenologically diagnosed organic diverticula of the stomach, personally observed by him, four of which belong to the type of «congenital» diverticula and are localized to the cardiac region, the fifth one being a case of post-operative diverticulum within the canalis ventriculi, verified and removed at the operation.

The diverticula of the stomach are of the greatest roentgenological interest from a differential-diagnostic standpoint. Roentgenologically they are characterized by a rounded shape, varying degrees of filling and distention, soft and mobile contour, an absence of roentgenological symptoms of an infiltration process in their surroundings. All five cases of diverticula of the stomach showed residues of the barium meal after 4 hours, and each of the four cases of cardiac diverticulum exhibited in erect posture a gas bubble in the upper portion of the diverticulum.

ZUSAMMENFASSUNG

Die spärlichen Angaben, welche in der Röntgenlitteratur über Magendivertikel anzutreffen sind, beziehen sich bis auf zwei Ausnahmen auf s. g. «funktionelle» Magendivertikel, die nach Ansicht des Verfassers durchwegs unrichtig gedeutet und in Wirklichkeit hinter dem Ventrikel gelegene Dünndarmdivertikel sind, ausgehend vom Endteil des Dünndarms oder von der Partie der Flexura duodenojejunalis.

Der Verfasser teilt aus seiner eigenen Beobachtung eine Serie von fünf röntgendiagnostizierten organischen Magendivertikeln mit, 4 dem Typus der «kongenitalen» Divertikel angehörige, im Kardiatrikt lokalisierte und einen fünften Fall, ein postoperatives Divertikel im Canalis ventriculi, das durch Operation verifiziert und entfernt wurde.

Die Magendivertikel haben ihr grösstes röntgenologisches Interesse vom differentialdiagnostischen Gesichtspunkt. Röntgenologisch charakterisiert werden sie durch ihre rundliche Form, durch wechselnden Füllungs- und Spannungsgrad, weiche und bewegliche Kontur und Fehlen aller röntgenologischen Anzeichen für einen Infiltrationsprozess in der Umgebung. Alle fünf Magendivertikel wiesen nach 4 Stunden persistierenden Kontrastinhalt auf, alle vier Kardialdivertikel zeigten bei stehender Stellung eine Gipfelgasblase.

RÉSUMÉ

Les indications peu nombreuses que l'on trouve dans la littérature radiologique sur les diverticules de l'estomac se rapportent — deux exceptions faites — à des diverticules de l'estomac dits « fonctionnels » en général mal interprétés d'après l'auteur; ce sont en réalité des diverticules du duodénum situés derrière le ventricule, ayant leur origine à la partie inférieure du duodénum ou bien dans la région de la flexure duodéno-jéjunale.

L'auteur communique ses propres observations d'une série de cinq diverticules de l'estomac organiques reconnus par un radiodiagnostic, quatre du type des diverticules « congénitaux » localisés dans la région cardiaque et le cinquième un diverticule apparu après une opération dans le canal ventriculaire, vérifié et enlevé par opération.

Les diverticules de l'estomac sont du plus grand intérêt radiologique d'un point de vue de diagnostic différentiel. Ils sont caractérisés radiologiquement par leur forme ronde, les différents degrés de remplissage et de distension, leur contour mou et changeant et l'absence de tous les symptômes radiologiques d'un processus d'infiltration dans leur entourage. Dans les cinq cas de diverticules de l'estomac on a pu observer après quatre heures les restes de la masse de contraste et tous les quatre diverticules cardiaques montraient une bulle de gaz à l'extrémité supérieure du diverticule.

LITERATURE

- ÅKERLUND, ÅKE: Magendivertikel simulierende Duodenaldivertikel an der Flexura duodeno-jejunalis. Fortschr. a. d. Geb. d. Röntgenstrahlen. B. XXVI. S. 327.
- ÅKERLUND, ÅKE: Röntgenologiska duodenalobservationer. Hygiea B. 81. 1919. S. 449.
- BROMAN, IVAR: Über die Phylogense der Bauspeicheldrüse. Verhandl. d. anat. Gesellsch. 1913.
- CARMAN, RUSSEL D.: The Roentgen diagnosis of diseases of the alimentary canal. Philadelphia and London, Saunders company 1920.
- FALCONER, A. W.: A case of congenital diverticulum of the stomach and duodenum in a physiological hour glass stomach. Lancet 1907 I. p. 1296.
- HANDTMANN, E.: Zur Kenntnis der Divertikel des Magens. Inaug. Diss. Jena 1912.
- VON HANSEMAN: Verhandl. der Gesellschaft deutsch. Naturforscher und Ärzte, Lübeck 1895.
- HEUBEL: Über ein mit dem Ductus Wirsungianus kommunizierendes Traktionsdivertikel des Magens. Deutsch. Arch. f. klin. Medizin. LV. 1895. S. 140.
- HIRSCH: Über ein Magendivertikel. Virchows Archiv Bd 173 nr 3.
- JONES: A case of diverticulum at the pylorus. Amer. Journ. of med. Assoc. 1909.
- KEITH, ARTHUR: Diverticula of the alimentary tract of congenital or of obscure origin. The British Med. Journ. 1910, vol. I. p. 376.



Fig. 2.



Fig. 3.



Fig. 4.

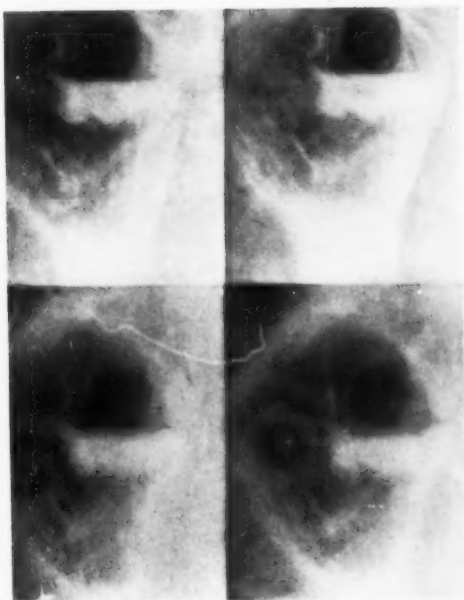


Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.



Fig. 10.



Fig. 11.



Fig. 12.

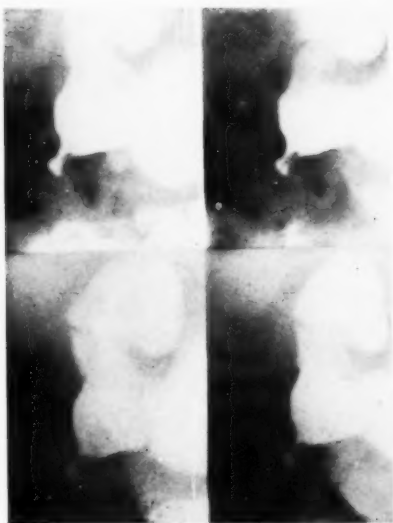


Fig. 13.



Fig. 14.



Fig. 15.



Fig. 16.



Fig. 17.



- KOLACZEK: Über ein Magendivertikel, das eine Neubildung vorgetäuscht hat. 73 Jahresber. d. schles. Gesellsch. f. vaterländ. Kultur, Abt. V. Medizin. 1895/96. S. 71—73.
- KOLACZEK: Ein durch ein Magengeschwür hervorgerufenen Magendivertikel, das eine Neubildung vorgetäuscht hat. Mitteil. a. d. Grenzgeb. der. med. u. chir. 1896. Bd 1.
- NAUWERCK, C.: Zur Kenntnis der Divertikel des Magens. Deutsch. med. Wochenschr., 1920. nr 5. S. 119.
- DE QUERVAIN, F.: Über Divertikelbildung am Magen, insbesondere über funktionelle Divertikel. Mitt. a. d. Grenzgeb. d. med. u. chir. 1915. Bd 28. H. 4. S. 690.
- ROTHBART, LADISLAUS: Echtes Magendivertikel. Fortschr. a. d. Geb. d. Röntgenstrahlen. B. XXX, nr 5/6. S. 563. April 1923.
- SCHINZ, H. R.: Das Ulcusleiden im Röntgenbild. Fortschr. a. d. Geb. d. Röntgenstrahlen, Ergänzungsband 34. 1921.
- SCHLESINGER, EMMO: Über Beobachtung von persistierenden spastischen Magendivertikeln beim Ulcus duodeni. Berl. klin. Wochenschr. 1917, nr 38. S. 915.
- SCHLESINGER, EMMO: Das epigastrale Dünndarmsdivertikel im Röntgenbilde, Med. Klinik 1920, nr 49. S. 1256.
- SCHULTÉN, M. A.: Über Haargeschwülste im Magen. Grenzgebiete B. 3 u. 4. 1897.
- STIERLIN, EDW.: Klinische Röntgendiagnostik des Verdauungskanal. Wiesbaden 1916. Verlag von J. F. Bergmann.
- THOREL, CH.: Pulsionsdivertikel im Magen. Sitzungsbericht des ärztlichen Vereins Nürnberg 1895. S. 57.
- TILGER: Über einen Fall von Traktionsdivertikel der Pylorusregion. Virchows Archiv Bd 133. S. 2.
- ZAHN, GEORG: Ein Beitrag zur pathologischen Anatomie der Magendivertikel. Deutsches Archiv f. klin. Medicin. Bd 63. 1899. S. 359.
- ZEHDE, M.: Über Duodeno-Jejunaldivertikel. Fortschr. a. d. Geb. d. Röntgenstrahlen, B. XXVIII, nr 2. S. 159, nr 5. S. 436.



DREI FÄLLE RÖNTGENOLOGISCHER NISCHE BEI MAGENKREBS

VON

G. Claessen

(Tabula XXVI)

Seitdem Haudeck im Jahre 1910 zum erstenmal das Nischensymptom im Röntgenbilde des *Ulc. ventriculi* in klassischer Form beschrieben hat, zählte man dieses Symptom zu den sichersten in der Röntgendiagnostik des Magengeschwürs. Die vorher schon bekannten Symptome, spastische Einziehungen, Lokalisation der Druckempfindlichkeit, Intermediärschichte, Sanduhrform, Stenoseerscheinungen und Retention mussten insgesamt als indirekte Röntgensymptome bezeichnet werden. Erst mit dem Nachweise der Nische erlangte man ein direktes Ulcussymptom, mit dem man in der Röntgendiagnostik als mit einem sicheren Symptom des U. v. rechnen zu können glaubte. Es hat sich aber im Laufe der letzten Jahre erwiesen, dass einzelne Verfasser Fälle mit Nischenschatten im Röntgenbilde von Magenkrebs beobachtet haben, welche ebenso aussahen wie Geschwürnischen. Die Mitteilungen hierüber sind jedoch sehr spärlich und in seiner überaus interessanten Abhandlung über das Nischensymptom bei Ca. v. (*Acta radiologica* Vol. I. Fasc. 3) hebt ÅKERLUND hervor, dass er bei Durchsicht der Fachliteratur nur sehr wenige Fälle mit *zweifelloser* Nische bei Ca. v. vorgefunden habe.

Man glaubte feststellen zu können, dass selbst tiefe Magengeschwüre, welche die Nische im Röntgenbilde veranlassen, unter diätetischer und medikamentöser Behandlung zur Heilung gebracht werden können und dass das Vorkommen der Nische keine absolute Indikation zur Operation darstellt. Die Differentialdiagnose zwischen Ulcus- und Cancernische ist daher überaus wichtig, was auch ÅKERLUND in seiner oben erwähnten Publikation hervorhebt. Die Diagnose wird sicherlich nicht aus dem Röntgenbilde allein gestellt, aber in so manchen Fällen trägt der Röntgenologe die Verantwortung hinsichtlich der Differentialdiagnose. Wenn in der Fachliteratur auch nur sparsame Mitteilungen über Nischen im Röntgenbilde des Magen-

krebses vorkommen, muss man doch in jedem Falle mit Nischen-symptom daran denken, ob nicht möglicherweise ein maligner Tumor oder ein gutartiges Geschwür vorliege. Leider ist es sehr schwierig zwischen einer Ulcus- und Cancernische zu unterscheiden. Die Diagnosen der bisher mitgeteilten Fälle von Cancernischen wurden zum grössten Teile erst nach der Operation gestellt. Man muss hoffen, dass es möglich sein wird, eine grössere Sicherheit in der Diagnose zu erlangen, sobald eine Reihe von Publikationen über Krebsfälle, welche dieses Symptom aufweisen, vorliegen wird. Da wir in letzterer Zeit drei solche Fälle auf der Klinik hatten, glaube ich, dass eine Mitteilung derselben von Interesse sein könnte.

**Fall 1. S. E. 45 J. Seekapitän.*

Seit 4 Monaten Schmerzen unter dem Rippenbogen, in die rechte Schulter ausstrahlend, nie kolikartigen Charakters. Ab und zu subfebril. Kein Husten, keine dyspeptischen Symptome oder Icterus. Kein Gewichtsverlust, Ernährungszustand gut. Stethoskopische Zeichen einer Infiltr. ap. p. d., und Pleuritis sicca. Die Leber fühlt man unterhalb des rechten Rippenbogens, kein Tumor im Epigastrium, Achylie Occ. Blut positiv. Klin. Diagnose Sequ. pleuritid. d. Ca. v.? Echinococcus hepatis?

Röntgenuntersuchung ^{20/6} 1922. Normale Stellung, Form und Beweglichkeit des Zwerchfells. Keine deutlichen Kalkschatten in der Leber, keine Deformität der obersten Leberkonturen. Am Magen sieht man in aufrechter Stellung (Fig. 1) eine spastische Einziehung der Curvatura major corporis und in der entsprechenden Höhe auf der kleinen Curvatur eine spitze, hackenförmige Nische ohne Andeutung einer schmäleren Verbindung zwischen Nische und Magenschatten. Die Curv. minor ist um die Nische herum ein wenig uneben und starr.

In Rückenlage (Fig. 2) ist die Nische noch deutlicher und ragt wie ein dornförmiger Schatten von der Curv. minor empor. Auf den Platten der Bauchlage sieht man eine begrenzte Unebenheit der Curvatur aber keine nischenförmige Ausbuchtung. Retention nach 4 Stunden; auf dieser Platte sieht man eine tiefe spastische Einziehung der Curv. major auf dem Canalis.

Röntgendiagnose: Tiefgehendes Ulc. curv. min. Es wurde jedoch im Röntgenjournale bemerkt, dass man mit Rücksicht auf die kurze Dauer der Krankheit, auf das Aussehen der Nische und der kleinen Curvatur (Unebenheit, Starre) mit einem Ulcus carcinomatosum rechnen müsse. Kein Zeichen eines Leberechinococcus.

Operation ^{20/6} 1922 (Dr. MATTH. EINARSSON). Recht grosses Carcinom an der kleinen Curvatur, das sich ein wenig auf die vordere und hintere Magenwand erstreckt. Der Tumor war durch karzinomatöse Infiltration an Netz und Leber fixiert; in diesen beiden Organen zahlreiche kleine metastatische Krebsknoten. Der Eingriff war nur zu explorativen Zwecken vorgenommen worden. Pat. bekam Bronchopneumonie und starb am 7. Juni 1922 unter zunehmenden Lungensymptomen.

Fall 2. G. R. 50 J. Landmann.

Seit 20 Jahren periodische Ulcusbeschwerden mit Schmerzen im Epigastrium. Fühlt sich einige Stunden nach der Mahlzeit am wohlsten. Keine

Abmagerung. Kein Erbrechen, keine Übelkeit. Kein fühlbarer Tumor. Leber unter der Curvatur nicht tastbar. Ewald Probemahlzeit 100 plus 30 cm schlecht chymifiziert. Freie H Cl Boas 15, Kongo 30, Totalacidit. 45, keine Retention nach 6 Stunden, Faeces Blutprobe positiv.

Röntgenuntersuchung ²⁹/₈. Auf der kleinen Curvatur eine grosse Nische (ca. $2 \times 3\frac{1}{2}$ cm), unregelmässig begrenzt, welche in aufrechter Stellung (Fig. 3) nur mittels Kompression mit Kontrastmittel gefüllt werden kann. Ohne Kompression sieht man nur einen horizontalen Fleck an Stelle der Nische. In Bauchlage (Fig. 4) tritt die Nische als eine konische Ausbuchtung mit regelmässiger Begrenzung hervor. Auf keiner Platte war ein s. g. «Hals» zwischen Nische und Magenschatten zu beobachten. Duodenum erweitert, Retention auch in der Nische nach $4\frac{1}{2}$ Stunden.

Röntgendiagnose: Penetrierendes Ulcus und Verwachsungen mit den Nachbarorganen.

Operation ¹⁴/₉ 1922 (Dr. HALLD. HANSEN). An der kleinen Curvatur ein grosses Ca., welches sich vom Pylorus bis zur Mitte des Corpus erstreckt. Bei der Palpation durch die Magenwand fühlt man einen tiefen Krater, in einem grossen Teile der Geschwulst Verwachsung mit dem Pankreas, in welchem sich eine Durchbruchshöhle vorfindet. Keine tastbaren Drüsenmetastasen. Resektion des Magens Billroth 2.

Pathologisch-anatomische Diagnose: Carcinoma ventriculi simplex.

Fall 3. E. S. 50 J. alt, Landwirt.

Dyspepsie mit Schmerzen durch 6 Jahre. Wiederholte Magenblutungen mit Melaena. Kein palpabler Tumor im Epigastrium: Tallquist 40, Ewald: Phenolphthalein 55, Kongo 30, Retention nach 10 Stunden. Medikamentöse und diätetische Behandlung erfolglos. Klinische Diagnose: Ulcus juxtaepylor. ventric.

Röntgenuntersuchung ²⁴/₁₀ 1922. Infolge Schwäche des Patienten kann eine Untersuchung im Stehen nicht vorgenommen werden. In Rückenlage (Fig. 5) sieht man an der kleinen Curvatur des Magenkorpus eine sehr grosse Nische (ca. 3×6 cm) mit unebenen Konturen und Andeutung einer Einschnürung, an der Stelle, wo sie von der Curvatur ausgeht. Röntgendiagnose: Grosses tiefgehendes Ulcus ventriculi.

Operation ²⁸/₁₀ 1922 (Dr. HALLD. HANSEN). Ein sehr grosser kraterförmiger krebsiger Tumor an der Curvatura minor, der sich ziemlich weit auf die Vor- und Hinterfläche des Magens erstreckt. Beginnende krebsige Infiltration im Pankreas und Mesocolon. Nur unbedeutende Drüsengeschwulst längs der Curvatura minor. Resektion des Magens nach Krönlein-Polya. Infolge einer hinzutretenden Pneumonie Exitus ²²/₁₁ 1922.

Pathologisch-anatomische Diagnose: Carcinoma.

Aus den mitgeteilten Krankengeschichten geht hervor, dass die Krebsdiagnose unter den drei Fällen einmal röntgenologisch gestellt wurde, und es scheint mir, dass die Differentialdiagnose zwischen Cancer und Ulcus als recht schwierig bezeichnet werden muss.

Lokalisation gab keine Veranlassung an einen malignen Tumor zu denken, die Nischen hatten ihren Sitz immer an der Curvatura minor corporis. Atypische Lokalisation wird sicherlich einen Fingerzeig für die richtige Beurteilung geben.

Kurze Krankheitsdauer kann man mit Recht als für Carcinom sprechend annehmen, aber man kann sich nicht darauf verlassen, da sich Nischen oft schon nach wenigen Monaten des Krankheitsverlaufes bilden können (siehe Fall 1). Auch durch Vorhandensein von Salzsäure darf man sich nicht täuschen lassen. (Fall 2 und 3.)

In den mitgeteilten Fällen der krebsigen Nischen war kein »Hals« zwischen Nische und der Magenwand selbst zu beobachten, was man pathol.-anatomisch so erklären kann, dass eine krebsige Infiltration der Magenwand eine Kontraktion der die Nische umgebenden Muskulatur verhindert. Bei einem der drei mitgeteilten Fälle war eine solche Einschnürung an der grossen Nische zu sehen, dort wo sich die Nische von der Magenwand abhebt. Da sich die Nische in diesem Falle zu einer grossen Höhle entwickelt hat, ist eine Erweiterung der Aushöhlung leicht verständlich. Aber es ist möglich, dass ein »Hals« in Form eines schmäleren Verbindungsstückes zwischen Nische und Curvatur bei den carcinomatösen Nischen fehlt.

Die Grösse und Form der Nische kann sehr verschieden sein, was man bei Vergleichung der mitgeteilten Fälle leicht ersehen kann. Der Schatten kann lang und schmal sein, dornförmig (Fig. 1) oder sehr breit und pilzförmig (Fall 3). Ich bin geneigt zu glauben, dass man bei grossen Nischen (2—3 cm im Durchschnitte und mehr) bei der Deutung vorsichtig sein soll. Sie werden sich sicherlich in vielen Fällen als bösartig erweisen. Dieselbe Erfahrung machte auch MAC CARTY (The Journal of the Am. med. Assoc. V. 79 No. 23).

Von grosser Wichtigkeit ist die äussere Begrenzung der Cancer-nische und das Aussehen des umgebenden Gewebes. In allen diesen Fällen hatte die Nische eine unebene Kontur und zeigte eine gewisse Unregelmässigkeit und Starre der Curvatur, wovon man den besten Eindruck bei der Durchleuchtung bekommt. Unebenheit und Ungleichmässigkeit sind für die durch Krebs bedingten Defekte im Magenschatten fast charakteristisch und dasselbe wird sicher oft bei Fällen zutreffen, bei welchen die krebsige Veränderung in der Nische auftritt, welche als Zuwachs des Magenschattens sichtbar ist.

ZUSAMMENFASSUNG

Nischen im Röntgenbilde des Magens sind keineswegs für Ulcus pathognomonisch, sie kommen auch bei Krebs des Magens vor, wenn auch in der Fachliteratur nur wenige Mitteilungen darüber vorliegen. Da man nicht alle Fälle mit Nischenbildung im Röntgenbilde operiert, sie vielmehr der medizinischen Behandlung zuweist, ist die röntgenologische Diagnose zwischen Ulcus und Krebs von grosser Bedeutung. Es werden drei Fälle mit Nischen

in der Curvatura minor corporis bei Patienten mit Magenkrebs mitgeteilt. Lokalisiert waren die Nischen wie beim Ulcus. Die Krankheitsdauer war in einem Falle nur 4 Monate. In zwei Fällen freie HCl im Magen, die Grössen der Nischen sehr verschieden. Bei grossen Nischen muss man aber darauf vorbereitet sein, Krebs vorzufinden. Eine grosse Bedeutung wird der unregelmässigen Kontur der Nische sowie der Unebenheit und Starre der Curvatur beigelegt.

SUMMARY

Niches in the roentgenograms of the stomach are by no means pathognomonic of ulcer, as they occur also in cancer of the stomach, although only scant reports on their occurrence have appeared in the literature. The roentgen diagnosis between ulcer and cancer is of great importance as one does not operate all cases exhibiting a niche in the roentgenogram which rather indicates of medical treatment. Reports are given on three cases with niches in the lesser curvature of the stomach in patients suffering from gastric cancer. The situation of the niches was in ulcer. In one case the complaint lasted only four months. In two cases there was free HCl in the stomach, the sizes of the niches varied greatly. In case of a large niche one must, however, be prepared to find cancer. Great importance is ascribed to the regular contour of the niche as well as to the unevenness and stiffness of the curvature.

RÉSUMÉ

Des niches dans l'image radiographique de l'estomac ne sont nullement pathognomoniques pour l'ulcus; on les trouve aussi dans des cas de cancer d'estomac; la littérature donne pourtant peu de renseignements là - dessus. Comme l'on n'opère pas tous les cas où la radiographie montre une niche et qu'on les soumet plutôt à un traitement médical, il est très important de pouvoir distinguer l'ulcus du cancer dans une image radiographique. L'auteur rapporte trois cas de niches dans la curvatura minor corporis chez des malades souffrant du cancer d'estomac. Ces niches étaient localisées comme dans les cas d'ulcères. Dans un des cas la durée de la maladie n'était que de 4 mois. Dans deux cas il y avait de l'acide chlorhydrique libre dans l'estomac; la grandeur des niches variait beaucoup. Toutefois si les niches sont grandes on devra s'attendre à trouver le cancer. On donne une grande importance aux contours irréguliers de la niche et à l'inégalité et la contraction de la curvature.





Fig. 1.



Fig. 2.



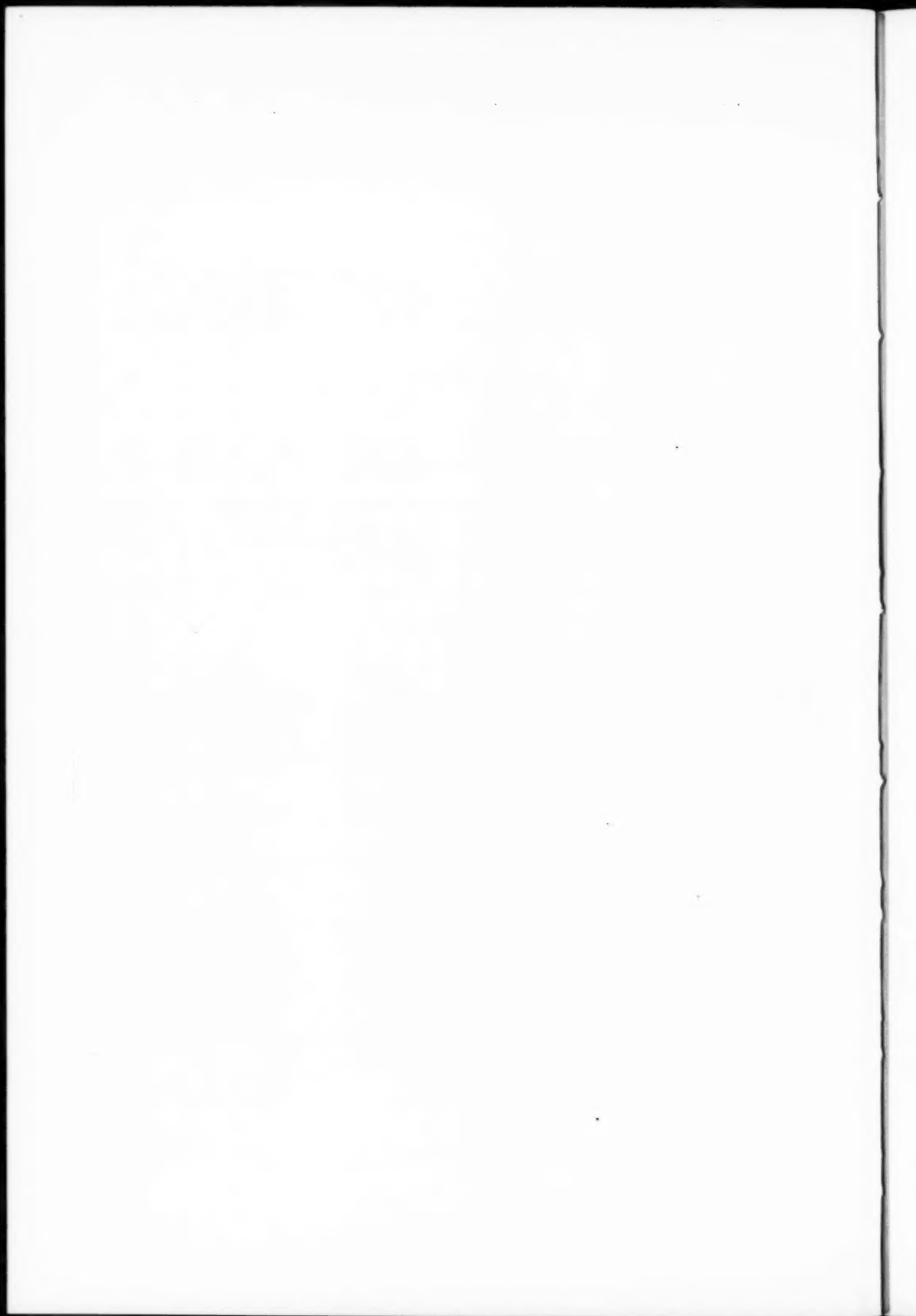
Fig. 3.



Fig. 4.



Fig. 5.



TRICHOBEZOARS IN THE STOMACH AND THEIR DEMONSTRATION BY ROENTGEN EXAMINATION

by

C. M. Rovsing

(2. Assistant Surgeon)

Trichobezoars are rather rare occurrences, and are found, so to say, only in the mentally inflicted, the feeble-minded, or the hysterical, who it must be said, often have characteristical gastronomic propensities.

In most cases the trichobezoars are only discovered on the dissecting table, and they have been diagnosed in living patients only in about 20 cases. Most of these cases relate to patients in whom an abdominal tumor has been diagnosed, which has been taken either for a sarcoma, a conglomeration of tuberculous glands, a kidney tumor, or a floating kidney, and where the real facts of the case have only been revealed at the subsequent operation.

In four cases the diagnosis has been made at the ordinary clinical examination, and Professor MONRAD has had the honour of having diagnosed one of these cases. It has been published in 'Acta Pædiatrica' in March 1921, together with a nextensive recapitulation of the literature on this subject.

In two cases the diagnosis was made at the Roentgenoscopic examination of the stomach, without the clinicians having been able to do so. Both these cases have been published in 'Arch. of the Roentgen-Ray'. The first case by HALLAND (July 1913). He obtained a characteristic picture when examining the stomach of a 29 years old woman, whose anamnesis gave no indication that she had eaten hair. He was able to state right enough that it was a question of a tumor in the stomach, though of what kind he was unable to see.

And there were many others, he writes, who were unable to make the diagnosis, and only one, BARCLEY, expressed as his surmise that it might be a case of trichobezoar. A relation of the patient stated later on that there was every probability of the diagnosis being correct, and 3 hair balls were subsequently removed by operation.

These were lying one above the other, and together they formed a figure which quite corresponded to the typical Roentgenogram of the hook-shaped stomach which we know from baryta examinations.

Shortly afterwards (October 1913) RAMSBOTTOM and BARCLAY published another case, which related to a 28 years old woman, in whose clinical history no information was to be gained which could lead to a right apprehension of the nature of the affection. A large tumor was found, which was first interpreted as a splenic tumor. The blood picture showed a low percentage of hemoglobin (65 %), being in other respects in a normal condition. The theory of a splenic tumor could not be sustained, especially on account of the mobility of the tumor, but no other diagnosis was forthcoming until BARCLAY, by Roentgenoscopic examination, at once diagnosed it trichobezoar. The patient denied the possibility of this, but her brother volunteered the information that 20 years ago, during an attack of scarlet fever, she had eaten nearly all her hair. Here, too a great hair ball was removed at the operation, and showed the same characteristic hook-shape as in the first case.

In addition to these two cases I can now report on a third, the history of which is as follows.

E. N. E. N., the 8 years old daughter of a mason, in Viborg. Admitted 2—10—20, discharged 4—11—20. Transferred from medical ward. No men-



Fig. 1.



Fig. 2.

tal affection or neurasthenia in the family. Four years ago it was discovered that she used to eat her hair. She is said to have eaten an entire head of hair, and also to be in the habit of biting her nails. For the last 6 months she is said not to have eaten any hair. In the new year 1920 she began to complain of pains in the cardia and along the course of the descending colon. As these pains increased, and as at the same time other nervous phenomena occurred, she was admitted to the provincial infirmary, where she lay for 3 weeks under the diagnosis nervous breakdown. Since her discharge from the infirmary the attacks have become worse, and in addition periodical vomitings of blood-stained mucus have occurred, together with alternate obstipation and diarrhea. Off and on there has been a slight rise in her temperature at night, to about 38° C. Her appetite is said to have been good. Hemoglobin 69 % (A-K), Ewald's test meal: Congo 10, Phenolphthalein 45, quantity 20 + 100. Fæces without blood or mucus. At the Roentgenoscopic examination of her stomach the following picture (Fig. 1.) was found: the baryta meal lies at the bottom of the stomach, which seems to be somewhat dilated, but above this another shadow is seen, shaped like a stomach and having a very distinct and dense outline, within which the shadow is more patchy. From the edge of this shadow a number of small excrescences are seen to protrude. In a second picture, taken with the patient in a recumbent position, (Fig. 2.) one can see the same small excrescences from the outline of the tumor within the stomach. In this picture the baryta is more evenly distributed over the surface of the tumor which seems to fill the stomach entirely. On the strength of these pictures Dr. PANNER, the chief of the Roentgen clinic, diagnosed it trichobezoar, for which reason she was transferred to Surgical Ward C. At the examination here we found a large sausage-shaped tumor extending across the epigastrium, and bulging distinctly through the abdominale-wall. On palpation it felt like a hard sausage-shaped, very mobile tumor extending right across the epigastrium from curvature to curvature. In its upper portion a peculiar crackling was felt, which was supposed to be due to air between the hairs of the ball. On 8-10-1920 laparotomy from the ensiform cartilage to the umbilicus was performed under ether narcosis. The stomach was greatly distended and contained a sausage-shaped foreign body. This reached up to the esophagus but not into the duodenum. There was sufficient space in the stomach to enable the tumor to shift its position. It (Fig. 3) was easily removed through an incision midway between and parallel to the curvatures. The mucous membrane of the stomach was red and swollen. The stomach wound was closed in 2 layers and the abdominal wound was sutured in 3 layers. The progress after the operation was smooth. During her stay in this ward no abnormal tendencies were observed in the child, who was discharged cured.

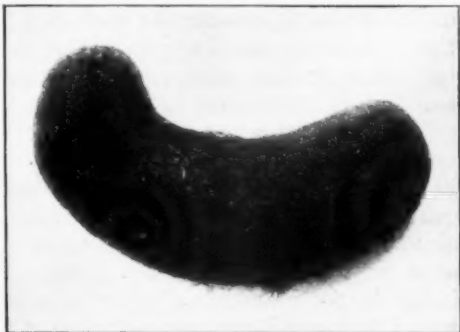


Fig. 3.

The clinical aspect is often very vague. At times there are no actual dyspeptic symptoms, but only ordinary nervous complaints, and anemia which is found almost constantly. As a rule the patients complain of anorexia and cardialgia. Sometimes there is vomiting, though not always. In the case of our patient there was only from time to time inconsiderable vomitings of mucous contents from the stomach. Sometimes, as in MONRAD's case, one may find hair and small tufts of wool in the vomits, because these patients also often eat the fluff of their wollen blankets, indeed even bits of coco-nut matting. In the evacuation one can sometimes also find particles of such. The evacuation is as a rule very irregular, obstipation and diarrhea alternating, and contains mucus and sometimes blood. A tumor in the epigastrium is always found at the objective examination. This tumor, which runs transversely and is of solid consistency and of the same shape as the stomach, is mobile. To be able to diagnose the case it is therefore necessary to ascertain that the tumor really lies in the stomach, which can be done either by inflating this with air, as MONRAD did in his case, or as in our case by Röntgenography.

Even if the practical interest of the Roentgen diagnosis is not great, because of the rareness of the disease, yet it is of importance in the individual case, as the Roentgen picture may be said to be quite pathognomonic. If one has once seen such a picture it is almost impossible to make a mistake, and as we have seen in the case just referred to, Dr. PANNER at the fluoroscopic examination immediately made the diagnosis at the first glance, because he remembered the two Roentgen pictures published by HALLAND and BARCLAY, although he knew nothing beforehand of the possibility of a trichobezoar being present, when the patient was handed over to him for examination of the stomach, with the diagnosis anemia and constipation.

After ingestion of the baryta meal the characteristic feature in the picture of the stomach in such a case is first a large defect in the stomach shadow, extending through almost the entire stomach, though without having the form characteristic of true tumors, as it has not got the irregular, indented and constant contours of these, and because to some extent it changes its appearance on manual pressure being applied. Secondly, we have the pathognomonic feature that during the fluoroscopy one can ascertain by pressure the presence of a movable foreign body in the stomach and push it up to a greater or lesser extent above the level of the baryta meal. The shadow of the pushed-up portion of the foreign body is outlined against the light portion of the stomach shadow which is due to

the air bubble in the stomach, but on the whole it is of small density as compared to the baryta meal. This has as a rule a reticular appearance, due to adherent portions of the baryta producing narrow and broad shadow stripes which cross one another irregularly.

The same picture which is obtained on pressing the hair ball up above the level of the baryta meal is naturally also obtained either if one awaits the emptying of the stomach, when the level of the contrast meal descends by itself below the upper edge of the trichobezoar, or if, as in our case, there is a dilatation of the stomach and the baryta meal in consequence only occupies the stomach declivity.

If the diagnosis is once made, inflation of the stomach with air will no doubt also give a good picture of the entire trichobezoar, which is sufficiently dense to be distinctly outlined against the air-filled stomach. Further, I want to call attention to the characteristic hook-shape of the trichobezoar.

From this it is evident that the Roentgen examination also in these cases is of capital assistance in reaching the correct diagnosis. There is no doubt that a trichobezoar in the stomach is a rare complaint, but in the few cases that may come into consideration it is extremely important to establish the diagnosis, as the prognosis will always be very serious if the correct treatment is not instituted at the right moment. Increasing anemia and insufficient nourishment weaken the patient, and one day ileus or perforating peritonitis sets in and ends his life. The treatment, therefore, must always be an operative removal of the trichobezoar by gastrotomy or, if it lies deeper, by enterotomy. In our case the operation went very smoothly, but the hair ball is often found extending a considerable length into the duodenum, and in such cases the removal may present greater difficulties.

In addition to the operative treatment a psychic treatment must be given in order to obviate a recurrence.

When one thinks of all the things that may otherwise pass through the intestinal canal one must wonder how the hair, which has been eaten little by little for months and years, can be retained in such quantities in the stomach, but this is due to the hairs having a finely intended surface, and to these teeth fixing themselves like barbes in the mucous membrane.

It is not always the stomach, however, that is the seat of such hair balls; they have been found not only in the small intestine but also in the colon, from which BREWSTER removed a hair ball which had given rise to an obstructing ileus.

SUMMARY

On Roentgenoscopic examination of the stomach of a girl aged 8 years, who for some time had suffered from digestive troubles, a peculiar picture was obtained, corresponding fairly well with a roentgenogram of a trichobezoar in the stomach, that has been published by BARCLAY. This Roentgen-diagnosis was verified at the operation.

A short account is given of the symptoms and prognosis. Gastrotomy and extraction of the foreign body is recommended as treatment to be employed.

ZUSAMMENFASSUNG

Bei röntgenoskopischer Untersuchung des Magens eines 8jährigen Mädchens, das einige Zeit an Verdauungsstörungen gelitten hatte, erhielt man ein eigentümliches Bild, das sehr gut mit einem von BARCLAY publizierten Röntgenogramm eines Trichobezoars im Magen übereinstimmte. Diese Röntgendiagnose wurde bei der Operation verifiziert.

Verf. gibt einen kurzen Bericht über die Symptome und die Prognose. Als Behandlung empfiehlt er Gastrotomie und Extraktion des Fremdkörpers.

RÉSUMÉ

L'examen radioscopique de l'estomac d'une fillette de 8 ans qui depuis quelque temps souffrait de maux de digestion, donna une image particulière correspondant très bien avec l'image radiographique d'un trichobézoard dans l'estomac, publiée par BARCLAY. L'opération montra que cette diagnose radiologique était juste.

Les symptômes et les pronostics sont brièvement relatés. La gastrotomie et l'extraction du corps étranger sont recommandées comme traitement.



RADIUM TREATMENT OF CANCER OF THE LIP

by

H. Lammers, M. D.

When I was composing the medical report of the «Radiotherapeutisch Instituut» for the year 1922, my interest was aroused for cancers of the lip by the simple fact that all the cases which had been treated by radium during that year, had been cured, thus forming an uninterrupted series of ten cases of successful treatment, successful of course with the restriction, that there will not be in future any bad complication either in the form of a local recurrence or as metastases distant from the seat of the original tumour.

Certainly a series of 10 cases of cancer of the same organ, cured throughout by the same treatment, may be regarded as a noteworthy fact, a fact indeed, that would possibly give rise to some bold conclusions concerning the effectiveness of the method of treatment. So I think it wise to say at once, that they all happened to belong to a more or less defined clinical group.

Even with this restriction it must be said that within this group some cases have been noted, which were already closely approaching the borders of operability, or had passed them, thus threatening the patient with that dreadfully morbid state — so well known — following in the train of the incurable cancer of the lip and the mouth: «Disdaining all therapeutical efforts, the tumour infiltrates the tissues of the lips; it lays hold of the adjoining parts of the gums and the underlying processus alveolaris; it grows into the cheek, destroying its inner layer of muscles and fasciae and forming prominent massive knots in the skin as well as in the mucous membranes inside the mouth. Necrosis and gangrene is the next stage. It is accompanied by hemorrhages and often by intense pain. Perforations then occur either in the lips or in the cheek or in both, causing gaps, out of which the spittle discharges itself in a continuous stream, a complication the more disagreeable and tormenting, because of the loathsome scent of the spittle being mixed up with the nauseous fetor of the rotting tumour itself. It need scarcely

be said, that before long the patient has the greatest trouble in taking his food; his nutrition gets disordered, his body emaciated; his sufferings are augmented by the metastases, which irrevocably develop in the glands of the sub- and retromandibular regions and the pains caused by these secondary tumours, which are so often described by the patients as unbearable and which, irradiate to the temple and to the occiput. In short, everyone knows the sad fate of patients in this deplorable state of the disease and the trouble they inflict upon the persons living with them in the same house. Is it to be wondered at, when death, finally caused by pneumonia or another intercurrent disease, is regarded as a release?

That we were able to check this dreaded fate in some cases, which had passed the borderline of operability, according to the surgeon who sent them for treatment, is of course most satisfactory and increases the importance of the results of our radium treatment. It is moreover owing to this fact, that I was induced to review all my cases of carcinoma of the lips, during the period in which I treated them exclusively by radium. This series contained 42 cases from the year 1915 until September 1922, when I first made my inquiry. It must till now be completed with 5 cases, the whole number amounting to 47 cases.

Though not so great as to allow of definite conclusions being drawn, this number nevertheless adds a contribution of some value so to the critic of this method of treatment in similar cases, the more as the publication of the «Institut de radium de l'université de Paris» of the year 1921 only contained 22 cases, some of which were even treated by X-rays alone and the publication of Gösta Forssell in 1918, of 34 cases, with 20 that had been treated exclusively by radium.

As to the result of these 47 treatments, it can be stated that 39 were cured; 7 were regressive during the treatment and died some time afterwards; and 1 treatment could not be continued to the due end, the patient being unwilling to submit to the medical arrangements.

Among the 7 cases, which could not be cured, there were 4 with more or less extensive metastases. These were treated — as they were considered inoperable by the surgeon — by X-rays, without any success however; 2 other cases were still without metastases in the regional glands, the mode of treatment, however, used before 1920, was still unable to check the growth of these extensive tumours, which had already deeply affected all the tissues of the lip and probably had infiltrated the layer of the muscles.

The remaining 7th case was a recurrence after several operations and was sent to my institute after a lot of preceding treatments.

There is great probability that this cancer, when it first recurred after the operation, might have been cured by a well-conducted radium treatment; it offers an example of a case, the prognosis of which got spoiled by a slackening treatment, which moreover is to be considered inappropriate.

Inst. No 3381. The patient, a man, 81 years of age, was operated 23 years ago; a tumour was extirpated from his under-lip near its left end. This first operation was a real success; it was not until 15 years later that another operation was deemed necessary, the tumour then having recurred near its former seat. Three years afterwards the tumour recurred for the second time, it was then treated by X-rays. As no amelioration could be stated, a third operation took place which was followed by a renewed X-ray treatment during several months; a more rapid growth was the only effect.

When the patient came to our institute for the first time, he showed a defect of great extension in the underlip and the adjoining parts of the left cheek. It was surrounded by an annular infiltration of cancerous tissue, which had laid hold of the remaining part of the underlip and of the cheek as well as of the left part of the upperlip. It had even attacked the mucous membrane, covering the *proc. alveolaris* inside the mouth. This far-extended ulcerative process bled when touched; it caused much pain and trouble to the patient, whose general state of health grew worse every day.

We resolve to make an attempt with an application of radium. Ten needles, containing radium, are pricked into the inner layer of the lips and the cheek. They irradiate an area round the defect, the edge of which is at the same time attacked from without by radium, enclosed in tubes. The metastasis in the submandibular gland gets another turn of radium treatment some days later.

We examine the state of our patient after about 5 weeks. There seems to be no doubt that the infiltration has softened in the centre. It made a distinct progress, on the contrary, near the periphery. Moreover we observe the increasing emaciation and the severe pains, from which the patient is suffering. We have the impression that no other treatment will be able to affect an influence upon this malignant tumour, which has grown wild by the several operations and which has acquired a distinct radio-immunity from the various preceding treatments by X-rays; so we abstain from further applications of radium. The patient died 2 months afterwards.

Thirty-nine patients were cured, as I stated before. I have tried to trace their fate inasmuch as it was not known to me from the periodical examinations which, as a rule, take place in my institute for such and similar cases.

Here is the result of this investigation:

Year of treatment	number of cases	still cured in 1923	without information
1915	2	1	1
1916	1	1	—
1917	4	4	—
1918	3	3	—

Year of treatment	number of cases	still cured in 1923	without information
1919	4	4	—
1920	10	7	3
1921	6	6	—
1922	5	5	—
1923 (till July)	4	4	—
	39	35	4

The result is surprising.

The prominent features of these cured cases can be described as follows:

I. Most had no metastases at all; only a few had such, in a stage, however, that the surgeon ventured to attack them by extirpation.

The course we followed in such cases was, that we began our treatment by the application of radium to the diseased lip as well as to the metastasis. The amelioration of the lip could be expected with fair certainty; as soon as it was evident, we finished the irradiation of the metastasis, which *then immediately* was extirpated by the surgeon. That this tactic may have good results is proved by one of my cases of this character, which remained cured after being treated in this manner several years ago. The prognosis however tends to the bad direction in all such circumstances in which the metastases are refused by the operator. According to my experience, they cannot be removed by X-rays, and radium could only be effective if introduced into the interior of the tumour itself, thus placing the healing power in the middle of the diseased tissues, without damaging the normal organs in the vicinity. It is this method which has focussed our attention more and more during the past year, and it is by its improvement that we hope to advance with our treatment in the near future. There is no reason why it should not have success in those cases in which the metastasis is still small and easy to move, so that the operator only need be troubled with the borderline cases.

II. The extension of the primary tumour in the lip was such as not to pass certain limits. These limits were rather narrow in former years. Of late they have been growing wider and wider on account of the greater quantity of radium at our disposal and especially on account of the technical improvements that have since been introduced into our method of treatment.

This may be proved by some photos of patients, taken before and after treatment. The most characteristic phenomenon according to my opinion is — save the brilliant cosmetic local result — the marvellous amelioration of the general state of the patients, who

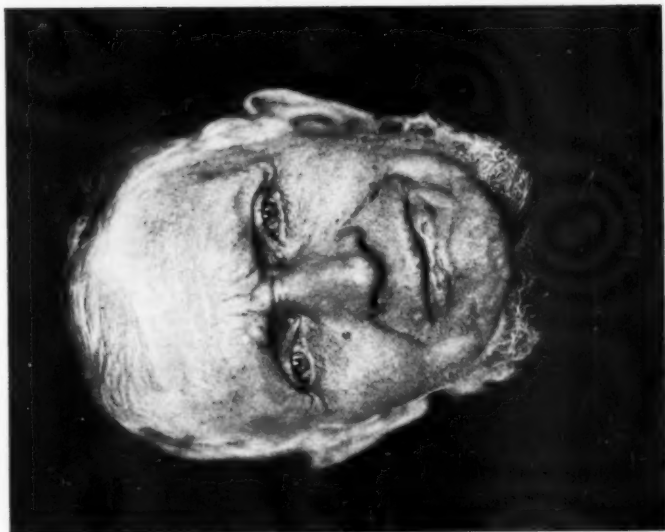


Photo II.



Photo I.

look rejuvenated and feel themselves likewise, as soon as the cure has been completed.

Photo I and II:

Man of 80 years. His disease began 2 years ago as a small prominent tumour of hard consistency in the middle of the underlip; gradually extending to either side as far as the corners of the mouth. Treated by small quantities of radium in another institute. In total 10 treatments, once in 8 weeks. The only effect has been that the whole lip from one end to the other has been transformed into a cancerous mass with rugged, ulcerating and bleeding surface. The edge of this cancerous mass is infiltrated. It causes much pain to the sufferer. No metastasis to be remarked.

We have in view the destruction of the whole cancerous mass by γ -rays. The swollen lip for this purpose is divided into 6 areas, each of which is attacked by radium, enclosed in brass tubes and the required secondary filters. The whole treatment is finished within 3 nights, the patient being allowed to walk about in the daytime. The dose corresponds with 18.3 «millicuries détruites», the active part of which is absorbed by the diseased tissues in a rather homogeneous way, according to the arrangement of the tubes and the due distance kept from the surface of the lip.

The reactive symptoms, coming on about a week afterwards, are severe, showing themselves likewise — though in a less intense form — at the upper lip, in spite of the applied protection.

Six weeks after treatment the reactive symptom have subsided, the lip itself is cured with a remarkable result concerning the cosmetic appearance.

Photo III and IV.

Man of 77 years of age, has suffered for several years from the underlip. It was operated 10 years ago by excision of the diseased parts. There was a recurrence after some years, which was treated by different methods without any success. It proceeded, on the contrary, over the whole lip and the whole chin, transforming them into a big bleeding and ulcerating mass of cancer with infiltration of the surrounding parts of the skin. No metastases!

For our treatment with radium, which took place in Jan. 1922, the surface of the malignant growth is divided in equal parts in order to effect the possibility of a homogeneous irradiation. No less than 10 areas are needed: these are attacked by radium, *lege artis* enclosed in tubes. The dose, which is applied within 3 successive nights, amounts to 39 «millicuries détruites». Reactive symptoms appear in both lips, in the tongue, the chin and even in the mucous membranes within the mouth. After they have abated, the state of the diseased lip ameliorates fast. It may be regarded as wholly cured at the beginning of April. In the meantime the exterior of the patient has ameliorated likewise, he feels himself rejuvenated. Last reexamination some months ago: no remaining symptoms of the former disease; exterior of the patient as seen on photo IV.

Photo V and VI.

Man, 66 years of age. He has been treated when a young man for an ulceration of the underlip by subcutaneous injections of mercury, although there never have been symptoms indicating a syphilitic infection. When married, he had one child, which always had a healthy constitution. His wife never suffered from an abortion. At present the reaction of WASSERMANN and of SACHS-GEORGI are negative.



Photo IV.



Photo III.

He has now a large cancerous growth, which has laid hold of the right part of the underlip and of the upperlip and has formed big proliferating tumours in the skin of the chin and the cheek. It has proceeded even to the mucous membranes inside the mouth where an extensive infiltration can be observed, starting from the right angle of the mouth. The surface of the growths is rugged and covered with dirty crusts. It shows light capillar hemorrhages, when touched.

Our treatment by radium consists of the application of 4 tubes outside on the surface of the tumour, covering all the diseased parts of both the lips and the cheek; and the application of another tube inside on the proliferation of the inner side of the cheek. The treatment, which is extended over 7 days, incorporates a γ -ray-dose amounting to 18,7 «millicuries détruites». It must be completed with 11 millicuries détruites more after 2 months. In the mean time there was as rapid amelioration, which, after the healing of the reactive symptoms, continued until the patient looked as shown by photo VI. This case is remarkable, as it demonstrates still better than the other cases the extraordinary effect of the treatment on the exterior of the patient. By photo V he is still shown as an individual who has wholly neglected his person, who is unwashed, unshaved, uncombed and shabbily clad. By photo VI we see him cured from the extensive cancer which disfigured his face and at the same time determined to make the best of his outward appearance.

Perhaps it would be of value to call attention to some more particularities concerning our treatment by radium.

In the first place some remarks about the metastases. We never saw them develop during or in consequence of our treatments. We had cases, as I said before, which were complicated in this way. But they all had their metastases before the beginning of the treatment. We had, on the contrary, among our cases such as had metastasized after a preceding operation.

As to the recurrences, we have been able to state that these may occur in the same way as they do sometimes after operation. There are 2 cases in our series, which recurred some years after a preceding successful treatment by radium. I am however glad to say that their sensibility to radiation had not diminished, and they could be cured for a second time as promptly as they had been by the first treatment. Perhaps there is some reason to suppose that the second growth is not to be identified with a real recurrence of the primary cancer. It is a well-known fact, that these recurrences after operation are first seen in the near vicinity of the scar or within the scar itself. In our two cases, on the contrary, the secondary tumours were seen to develop rather far from the seat of the original cancer. It is the same question, to be discussed in those circumstances in which, for instance, both the female breasts or both the ovaries etc. are invaded by cancer. Are these malignant growths connected together in some way or another; or do they develop in-



Photo VI.



Photo V.

dependently, the causative agent working at once in both the organs?

As to the different types of the cancer of the lip, we pointed out already that all the cured ones belonged to a more or less defined clinical group. It must however be born in mind that, besides the clinical characteristics, the result of the treatment is dependent on the microscopical structure, as there is no doubt of there being a relation between the morphology of the malignant cells and their physiology and consequently between the microscopical structure of the growth and its sensibility to radiations. It would be of high importance in future, and would add a great deal to the possibility of determining the optimum dose for each case, if the pathologist would not confine his diagnosis — if such is made at all — to the simple statement «carcinoma or not» but would give a hint as to the histological structure of the growth of the lip. There is still a lot of work to be done in finding out the differences of radiosensibility in the different types of carcinoma, a work that is not facilitated by the fact, that the authors often use a different terminology. Up to the present, however, it may be regarded as a definitely stated fact, that the epithelioma baso-cellulare is highly radio-sensitive, whereas the epithelioma spinocellulare has proved to be less. Its resistance however is not so great as to offer any difficulty to the γ -treatment.

Only a few words as to the technique:

This can of course not be the same in all cases. In the majority we apply the beforehand calculated dose, consisting of pure γ -rays, in a single sitting, lasting a day and a night. For this purpose we construct moulds of plastic material (for the past year we have used the so-called Colombia, a mixture of wax and paraffine, composed by the Parisian school of Prof. Regaud). This material is correctly adjusted to the diseased lip and to the deformity it has undergone by the proliferations and ulcerations. Within this applicator are included not only the radioactive source in its well-calculated metal filter, but also the plate of lead, protecting the other lip, the tongue etc. The plastic material itself acts at the same time as a filter for the secondary rays of the included metals. By all this, there will be formed a rather big apparatus, which, when applied, will keep the mouth widely opened. That this will cause the sufferer a certain amount of pain and fatigue is not to be denied. The situation can be made, however, fairly bearable by giving the patient an injection of morphine at the beginning of the night, a remedy which will also contribute to prevent an eventual trismus of the jaws.

There remain a number of cases not suitable for this method of plastic application of radium, which — when carried out in the right way — will often afford brilliant results. These remaining cases can be treated by the method of the so-called radio-puncture, a manipulation which has in view the incorporation of the radioactive material into the tissue of the tumour itself. It is done by needles, the number of which varies according to the size of the malignant affection. Though painful during the little operation itself, this method offers a wide prospect. When it is proved to be an exact observation, that the sensitiveness of cells to radiation is greatest in their state of «Kariokynesis» and moreover that all the cells of a malignant tumour divide themselves in a limited number of days, is it even possible that the more slowly-working needles will have some advantage over the tubes, as they hit the cells, in the period that they have the least resistance, a circumstance, which allows a diminution of the quantity of the rays necessary. From our experience, however, we believe that the 2 methods described will both maintain their value in radium therapy of cancer of the lips. It will depend chiefly on external particulars — in future perhaps of histological findings — as to which method is to be followed in a concrete case.

SUMMARY

The author having obtained in 1922 the cure of 10 cases of cancer of the lip by treatment with radium alone, was led by this fact to establish an inquiry into all the cases of the same affection treated at his institute from 1915 to September 1923; there were 47 in all. All these cancers treated exclusively with radium yield the following result: 39 cures and 7 cases where in spite of the treatment the affection only grew worse, finally ending by the decease of the patient. Out of the 39 patients cured, 35 were still entirely immune in September 1923, the other 4 have been lost sight of. The investigation shows cures lasting from three months to 9 years.

ZUSAMMENFASSUNG

Durch die Tatsache veranlasst, dass im Jahre 1922 eine Serie von 10 Fällen von Lippenkrebs ausschliesslich durch Radiumbehandlung geheilt wurde, hat Verfasser sämtliche fälle von Lippenkrebs von 1915 an bis September 1923 revidiert. Die Zahl betrug 47 Fälle, die also alle ausschliesslich mit Radium, ohne jegliches andere Mittel behandelt wurden. Das Resultat dieser Behandlungen war in Kürze Folgendes: 39 Fälle wurden geheilt; 7 blieben trotz der Behandlung regressiv und starben nach längerer oder kürzerer Zeit an den Folgen der Krankheit, so wie oben beschrieben.

Über das Los der geheilten Kranken wurden Erkundigungen eingezogen mit dem immerhin überraschenden Resultat, dass in September 1923 noch 35 völlig geheilt geblieben waren, während von den 4 übrigen keine Nachricht einging. Die Nachforschung ergab also Heilungen, mit einer Dauer bis jetzt von 3 Monaten bis 9 Jahren.

RÉSUMÉ

L'auteur ayant obtenu en 1922 la guérison de 10 cancers à la lèvre par le traitement au radium seul, fut conduit par ce fait à établir une enquête sur tous les cas de la même affection traités chez lui de 1915 à Septembre 1923; il y en avait 47. Tous ces cancers traités au radium exclusivement donnèrent le résultat suivant: 39 guérisons et 7 cas où malgré le traitement l'affection ne fit qu'empirer, amenant finalement le décès du malade. Sur les 39 malades guéris 35 étaient encore tout à fait indemnes en Septembre 1923, les 4 autres ont été perdus de vue. L'enquête nous met donc en présence de guérisons durant entre 3 mois et 9 ans.



ANOTHER CASE OF SPONDYLITIS TYPHOSA

by

Abraham Troell, M. D., Stockholm

In Nr. 6, 1923, of this journal BAKKE has described a case of spondylitis, the symptoms of which appeared in a rather intimate connection with a clinically unmistakable typhoid, and in which the WIDAL reaction proved positively the presence of paratyphus bacilli about half a year after the onset of the acute abdominal symptoms. Some years ago I saw a similar case, its clinical history and the description of the details in the roentgenogram almost coinciding with those in BAKKE's case. As typhoid of the spine and bone typhoid in general does not seem to be very well-known as yet, I think a report on my case might be of some interest.

The patient was a custom-house officer, 36 years of age. At the age of 14 he was taken ill with pneumonia. In 1910 and 1916 he had an intestinal catarrhal infection for two or three months. From July 12th to Sept. 1st 1918 he was nursed for typhoid fever in a hospital. In Oct. 1919 he had influenza. Ever since his typhoid he had sometimes felt pains in his back on movements. On May 6th 1919 he felt aching in the lumbar region of his back, without any known reason. The aching increased during the first few days and continued then for a month. It was most intense at night and on some days he could feel very much relieved. When the pains were at their highest, the temperature remained steadily over 39° C. After about a month the pains began to disappear, and have later come on only on attempting to bend or to lift. After having been treated in different hospitals in his native place, from May to October, he was admitted on Nov. 22nd 1919 to the surgical department II of the Seraphimer Hospital in Stockholm. Nothing abnormal about the general condition, pulse, temperature or urine. The patellar reflexes somewhat lessened. No deformity in the spinal region. No discomfort when resting quietly. Owing to pains which he assigns to the musculature on either side of the lumbar spinal column (though mostly to the left side), he is not able to bend his back quite to the horizontal position. The degree of lateral and rotatory movements of the spinal column is somewhat diminished. On attempting to pick up something from the floor the greatest movement takes place in the knee joints. No perceivable deformity, but distinct tenderness over the 3rd lumbar vertebra. Pressure on the head causes pain in the lumbar musculature on the left side of the spinal column.

Widal's reaction positive for typhoid after two days. Roentgen examination (Larsén) reveals: 'The intervertebral disc between the 2nd and 3rd lumbar vertebrae is considerably diminished. The contours of the two opposing surfaces of the 2nd and 3rd lumbar vertebrae are rugged and blurred, the right



upper corner of the latter one being especially ragged and notched. A fairly broad bridge-like bony connection is stretching between the 3rd and 4th lumbar vertebrae. It is a case of spondylitis, the intimate nature of which can not be determined solely by the roentgen plate. It may possibly be a case of septic spondylitis (typhoid?). Cf. fig.

The patient was at first confined to bed and was later on treated with extension for three weeks. In March 1920 he got a leather corset and was allowed to be up and about. He got gradually better and was discharged from the hospital on the 8/5/1920. Even during the last few weeks before his discharge he used to feel transient pains just after he had gone to bed in the evening. No apparent change could be found in the roentgen picture at the repeated examinations. In the roentgenogram taken on February 21st 1920 the intervertebral disc between the two affected vertebrae seemed possibly to be shorter in height than before.

There is nothing to add as to the diagnosis. BAKKE has in his article to some extent treated

of the symptoms from a differential diagnostic point of view. For further informations I refer to, inter alia, the paper of BOHMANSSON 'on the diagnosis and therapy of bone typhoid', published in the *Annals of Surgery*, March 1919, pag. 245.

As to the diagnosis one should, against spondylitis deformans, bear in mind firstly the *age* and anamnesis of the patient (no trauma, *an attack of typhoid fever just ended*), and secondly the combination of the pains with *fever* (which is high at first) and their being mostly concentrated to the musculature at the sides of the lumbar spinal column. The *solitary* appearance of *bone changes* is also very noticeable, as well as their principally *productive* character (the formation of a solid bone bridge between two vertebrae), the latter being quite different to those of tuberculous spondylitis.

SUMMARY

A man, 36 years of age, got pain in his back, immediately after having had typhoid; sometimes also fever (39° C.). About a year later an X-ray plate was taken. It showed a fairly broad bridge-like bony connection, stretching between the 3rd and 4th lumbar vertebrae. WIDALS reaction was positive for typhoid.

ZUSAMMENFASSUNG

Ein 36jähriger Mann bekam, unmittelbar nachdem er eine Typhuserkrankung überstanden, Rückenschmerzen; zeitweise auch Fieber (39° C.). Ungefähr ein Jahr später wurde eine Röntgenaufnahme gemacht. Sie zeigte eine recht breite brückenartige knöcherne Verbindung, die sich zwischen dem 3. und 4. Lumbalwirbel erstreckte. WIDALS Typhusreaktion fiel positiv aus.

RÉSUMÉ

Un homme, âgé de 36 ans, eut mal dans son dos, immédiatement après la fièvre typhoïde; il avait parfois aussi de la fièvre (39° C.). Un an plus tard l'image radiographique montra une connexion assez large, osseuse, en forme de pont entre la 3^{ème} et la 4^{ème} vertèbre lombaire. La réaction de WIDAL était positive pour la fièvre typhoïde.



A NEW MERCURY INTERRUPTOR

by

Erik Lysholm

(Assist. Physician)

In the following description the largest errors in the existing interruptors are pointed out, and how those have been eliminated by the new design.

The rotating part, «the rotor», consists generally of 2 bent tubes. The disadvantage of this design is that eddies are formed in the air of the casing and that, owing to the small weight of the rotor, variations in the angular velocity will arise, giving an uneven running. Further, the tubes are very difficult to clean. In its present design, the rotor (fig. 1:2) consists of a turned steel cylinder a) with straight and wide holes b), which are easy to clean. Owing to the heavy mass of the rotor, the running of same will be much better, as the rotor acts as a fly wheel.

In the centre of the rotor a hole is drilled, in which grease leaking from the bearings is taken up, thus preventing the grease from be-

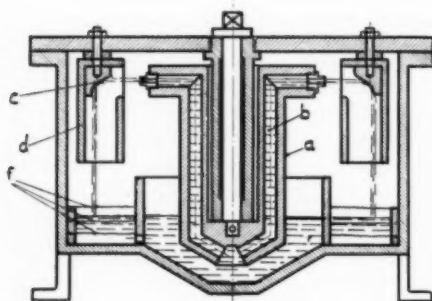


Fig. 1.

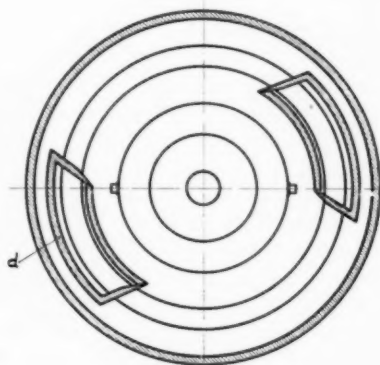


Fig. 2.

coming mixed with the mercury and changing the conductivity of same.

The segments of an interruptor of orthodox design consist of flat plates. When the mercury jet hits the plates (fig. 3), it is atomized, mercury drops being thrown in all directions, thereby causing the circuit to be made at such moments when it is not desired. In this way the primary and the secondary current will be of an uneven character, a fact which has been verified by taking oscillograms. In the new design the segments are formed of curved surfaces *c*) which are designed in such a way that the jet is deflected without shock or atomizing. (Fig. 4.)

In the old interruptors the break is produced in such a manner, that the jet leaves the segment, and thus the period of the break will depend on the peripheral speed of the rotating jet. It is evident that the period of break is of great importance for the character of the secondary curve. In this design the mercury jet

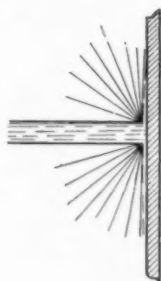


Fig. 3.

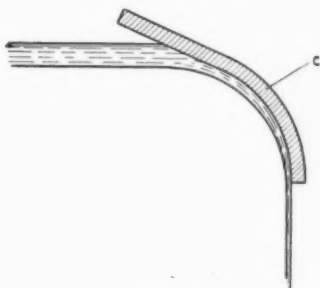


Fig. 4.

itself is cut with a knife edge *f*), which forms such an angle with the jet, that the jet is cut through without a shock, i. e. knife is parallel with the direction of the flow of particles in the jet. When the mercury jet leaves the nozzles of the rotor it has, of course, the same peripheral speed (fig. 5 *p*) as the rotor itself, but at the same time the centrifugal forces give a radial speed of about the same value *r*). Thus, the resulting speed of the mercury jet will be

$$S = \sqrt{p^2 + r^2} \cong \sqrt{2} \cdot p$$

or about 40 %

higher than the peripheral speed of the nozzle. The direction of flow is indicated by arrows S_1 and S_2 in the sketch. It is then easily

understood that the period of break will be $2 \times 1,4$ or practically 3 times as small as with usual interruptors, the peripheral speed being the same.

When the mercury jet in older designs strikes the casing it will be thrown back, causing extra currents. In order to avoid this, the

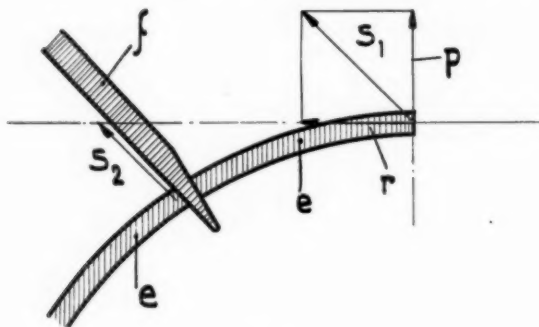


Fig. 5.

segments are enclosed in a casing of porcelain (made by A. B. Rörstrands Porslinsfabrik). This casing is at the same time acting as knife edges. Fig. 1 : 2 : 6.

In all mercury interruptors it is impossible to avoid oxidation of the jet. By the spark formed at the breaks, the mercury is oxidized by oxygen in the atmosphere of the casing. This oxidation of mercury reduces the conductivity of the fluid, and when it reaches a certain percentage it is necessary to purify the mercury. In this

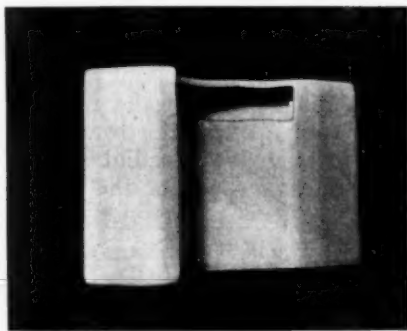


Fig. 6.

design the mercury is continually purified by a filter. According to experiments made in America by Mr. Emmet with a mercury steam turbine, the mercury can be thoroughly purified by a filter consisting of a steel wire gauze, which has been heated to a high temperature and allowed to cool gradually. A filter *f*) according to this idea and consisting of several layers of fine steel wire gauze is placed at the bottom of the casing, in such a way, that the circulating mercury has to pass through the filter.

The interruptor is manufactured by Jährns Elektriska Aktiebolag, Stockholm.

SUMMARY

The author describes a mercury interruptor, where the break is produced by the mercury jet being cut by a porcelain knife. The segments consist of curved surfaces and are enclosed in a porcelain casing. The rotating portion is composed of a heavy steel cylinder, serving as a fly wheel. The mercury is continuously purified by means of a filter arrangement.

ZUSAMMENFASSUNG

Der Verfasser beschreibt einen Hg-Unterbrecher, bei welchem die Unterbrechung in der Weise geschieht, dass der Quecksilberstrahl durch ein Porzellanmesser durchschnitten wird. Die Segmente haben gewölbte Flächen und sind in einem Porzellangehäuse eingeschlossen. Der rotierende Teil besteht aus einem schweren Stahlzylinder, der als Schwungrad wirkt. Das Quecksilber wird durch eine Filtriervorrichtung kontinuierlich gereinigt.

RÉSUMÉ

L'auteur décrit un interrupteur à mercure où l'interruption se fait de la sorte que le jet de mercure est coupé par un couteau en porcelaine. Les segments sont des surfaces courbées et sont renfermés dans un manteau en porcelaine. Le rotor est un lourd cylindre en acier qui sert de volant. Un arrangement est pris pour purifier le mercure continuellement en le filtrant.



APPARATUS FOR THE PRODUCTION OF A NARROW BEAM OF RAYS IN TREATMENT BY RADIUM AT A DISTANCE

by

Erik Lysholm

(Assist. Physician)

Up to the present time the radium treatment at a distance has been used mostly in America, and the method employed has been the so-called «Radium-pack». A sufficient quantity of radium has been placed on a plate of balsam wood or cork, the thickness of which is equal to the distance at which treatment is being applied.

The principal disadvantages of this method are:

1) As the radium is radiating in all directions it is impossible to restrict the area to be treated and to sufficiently protect the patient, which is of special importance in treatments in the neighbourhood of the endocrinous glands or of hematogenous organs, e. g. in treatment of the neck.

2) It is difficult to protect those attending on the patient as well as the other patients in the room, when there is not a special room for such treatments.

3) By interposing between the radium and the skin a body of low density we get great quantities of β -rays on the field of treatment, and thereby get an erroneous idea of the dosage. The skin reaction is probably in a large degree dependent upon the β -rays, and one does not get a proper idea of the extent to which the skin reaction is due to the γ -rays. The importance of knowing the effect of the β -rays has been shown by a research carried out by Sievert (Acta Rad. II: 3).

During the time in which treatments at a distance have been given at Radiumhemmet, we have been working on somewhat different principles, using an apparatus constructed by me. The radium is enclosed in a cylinder of lead (howitzer), its inner diameter measuring 5 cm. and the thickness of the metal 2 cm. The quantity of the hardest γ -rays is thereby reduced to about 25 %. To be able to vary the distance, the radium preparations are placed on a sort

of piston which can be moved up and down in the cylinder. The area of the field to be treated is varied in two ways, partly by placing a kind of diaphragm in the opening of the cylinder, and partly by varying the distance of the radium from the opening, the distance of which will thus be determinative of the area of the field. Fig. 1 shows a section through the cylinder.

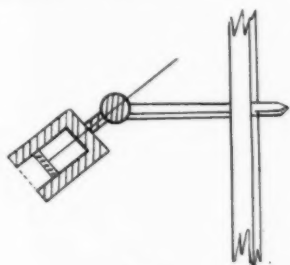


Fig. 1.

For the application of the apparatus to the patient two methods have been employed.

1) The howitzer has on its upper surface a ball-joint which is attached to the arm of an ordinary roentgen treatment stand. Through the ball-joint the piston rod passes. The piston rod is graduated and by this means the exact position of the radium in the howitzer is determined. The patient is secured in position by the aid of sand-bags or, in treatments of the scalp, by arrangements similar to those

used in Roentgen diagnosis. The howitzer is put in position just like a Roentgen tube. Two metal pointers are arranged along the tube, diametrically opposite one another. These pointers are inserted into rings attached to the patient by adhesive plaster and so arranged that if the patient moves a contact is produced between the pointer and the ring, which closes an electric circuit and thereby rings a bell that calls the nurse's attention to the patient. The patient receives a treatment for a couple of hours at a time and then rests for another couple of hours. While the patient is resting, the howitzer can be swung round and used for treating a patient in the next bed.

2) An arrangement by which the howitzer is attached directly to the field of treatment, is made on the following lines. A base plate consisting of rubber a few millimeters thick and with a hole corresponding to the field to be treated is attached to the patient by means of leather straps. To the plate 4 hooks are attached which fit into recesses in the howitzer and allow of some movement and which can be screwed down to secure good contact between the howitzer and the rubber plate. To prevent the weight of the howitzer pressing on the patient, it is suspended by a long wire which passes over pulleys at each end of a balance arm, and a counter-poise is placed at the other end of the wire. The cylinder has a lid of lead 2 cm. thick which can be screwed off and on.

The application is made in the following way. First the base plate is attached. Then the cylinder is swung over the field to be treated and is centred. It is then secured in position by means of

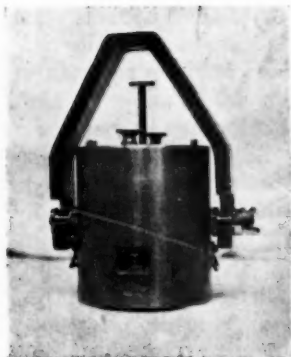


Fig. 2.

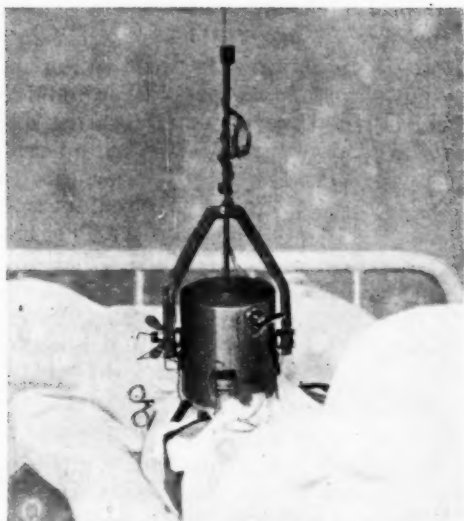


Fig. 3.

the hooks. When everything is arranged, the radium which is attached to the lid is carefully screwed into position and counterpoised. By this arrangement the patient is free to move slightly and can have a longer treatment. The figures show the apparatus.

By means of this apparatus one can treat at a distance, restricting the field of treatment very exactly.

Protection of the patient and the attendants is secured.

The space between the radium and the patient is only filled with air. The apparatus can be used as a γ -ray apparatus only or as a β - and γ -ray apparatus by interposing a filter of copper between the radium and the patient, as indicated by Sievert in *Acta Radiologica* II: 3.

By using emanation the apparatus can be made smaller, and in deep therapy a method of cross-fire can be adopted.

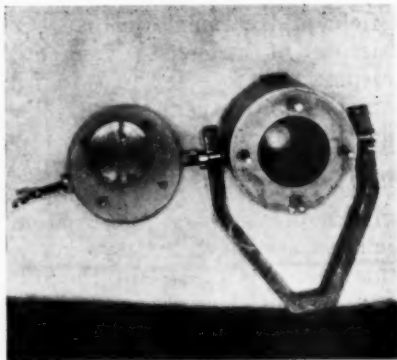


Fig. 4.

SUMMARY

The author describes an arrangement for treatment by radium at a distance, the radium being enclosed in a cylinder of lead. The thickness of the metal is 2 cm. The application is done partly by adjusting the cylinder by means of a stand as in ordinary Roentgen treatment, and partly by the cylinder being carefully counter-balanced by means of a counter-poise and attached to the patient by means of leather straps.

ZUSAMMENFASSUNG

Der Verf. beschreibt eine Vorrichtung zur Distanzbehandlung mit Radium, bei welcher dasselbe in einem 2 cm. dicken Bleizylinder eingeschlossen ist. Die Applikation geschieht entweder durch Einstellung mit einem Stativ, wie es bei gewöhnlicher Röntgenbehandlung zur Anwendung kommt oder so dass der Bleizylinder durch ein bewegliches Gegengewicht genau ausbalanciert ist und an dem Patienten mittels einer Riemenvorrichtung befestigt wird.

RÉSUMÉ

L'auteur décrit un appareil pour traitement radiologique à distance où le radium est renfermé dans un cylindre de plomb de 2 cm. d'épaisseur. On l'applique soit en le mettant au point à l'aide d'un support comme pour un traitement ordinaire aux rayons X, soit en équilibrant le cylindre par un contre-poids mouvable et en le fixant au malade par des courroies.



K. SIGFRID STRÖM

In Memoriam

One of the most devoted and clever votaries of swedish roentgenology has paid the debt of nature, in that Doctor SIGFRID STRÖM was suddenly carried off in the prime of life on August the thirteenth of this year. SIGFRID STRÖM was born in Gothenburg on March 23, 1886. His medical studies were pursued in Stockholm, where he took his degree as Bachelor of Medicine on May 8, 1915. He obtained his training for the profession of radiologist by studies at the "Radiumhemmet" in Stockholm and at the Roentgen Department of the Seraphimer Hospital in Stockholm, where during the years of 1916 and 1917 he was engaged as assistant roentgenologist. From 1918 to 1921 he practised as roentgenologist partly at the Military Hospital and at the Maria Hospital, partly at Professor FORSELL's private Roentgen Institute in Stockholm, until June 10 th, 1921, when he obtained the post of Chief at the Roentgen Department of the County Hospital in Umeå in the North of Sweden.

STRÖM has made several valuable contributions to roentgen diagnostics. In the first volume of this journal he gave a very detailed description of the roentgen pictures of changes in the appendix and caecum; and in this number there is inserted an interesting contribution from his hand to the roentgen diagnosis of *ulcus pepticum jejuni*. He has also carried out valuable investigations on the roentgen diagnostics in changes in the human brain and has done some works on roentgen diagnostics in changes in the urinary apparatus.

He leaves a widow and two young children to mourn his loss besides a host of kith and kin.

His working-day was short, yet it sufficed to erect for himself a lasting memorial in the annals of swedish radiology by his sense of duty and proficiency in his calling, his love for science, and by the simple integrity of his character.

Gösta Forssell



